THE

Photographic Tourist,

GIVING FULL DIRECTIONS

FOR

LANDSCAPE PHOTOGRAPHY,

AND CONTAINING A DESCRIPTION OF THE MANIPULATION AND APPARATUS REQUIRED FOR THE

COLLODIO-ALBUMEN, FOTHERGILL'S, TANNIN, CALOTYPE, WAXED PAPER, AND OXYMEL PROCESSES, WET COLLODION, AND INSTANTANEOUS PHOTOGRAPHY.

ALSO DIRECTIONS FOR

PRINTING POSITIVE COPIES ON PAPER OR ON GLASS,

EITHER AS

TRANSPARENT STEREOSCOPIC VIEWS,

OR FOR USE AS

MAGIC LANTERN SLIDERS.

FOURTH EDITION.

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INTRODUCTION.

PHOTOGRAPHY vies with any other science or discovery of modern date in its general usefulness and adaptability for the amusement and instruction of the present and future generations. It is wholly of recent origin, and is familiarly seen in the case of marking ink, as it is called, or the liquid used for permanently writing on cotton or linen fabric, nitrate of silver being the active agent in most of these preparations. The superiority of photographic delineation over all others is its absolute fidelity, as contradistinguished from the work of even the most accomplished and skilful draughtsman, who invariably impresses his pictures with the mannerism which distinguishes his style. Thus there is about photographs a certain degree of reality which gives to them in many instances incalculable value. Photography is now turned to a multiplicity of uses : it not only registers the force and direction of the wind for meteorological purposes, but also the face and figure of the criminal ; it catches the sunbeam and fleeting cloud ; it reveals the secrets of the ocean ; and has done wonders for the artist, making him familiar with scenes, manners, and customs which he is unable to visit. It is scarcely, then, too much to say that its practice must become all but universal, and every improvement in its process is of public importance.

The aim of the writer of the following pages has been to collect such reliable information on the manipulation as would enable a person tolerably conversant with photography to succeed in producing a satisfactory result. I am repeatedly asked, What process do you really recommend ? There is no straightforward answer to be given to this question ; much depends on the practice that has been had. An operator who has been used to the Fothergill or the Collodio-albumen

process is naturally more successful with them than with any other, while some express their sole faith to be in wet Collodion. An examination of the specimens exhibited will not afford much assistance, for there are in most exhibitions many bad pictures taken by all processes, and some very first-rate are produced by every method that is generally known. Those who are successfully practising a process to which they are accustomed must not expect to get finer results by a chance shot among new dodges. There is no doubt but that the best pictures yet exhibited have been taken with wet Collodion; next to these come Collodio-albumen; then Fothergill, when of a small size, but not on a large scale. The amateur desirous of commencing out-door photography had better first consider if he will be able to manage or inclined to submit to the annoyance of tents, chemicals, and manipulation away from home; if these difficulties are not too great to be overcome, by all means take to wet Collodion, and keep to it, using a few dry plates only as an auxiliar: under these circumstances the Tannin process would be suitable.

Collodio-albumen I firmly believe to be the best for general purposes that has been brought into notice: the plates prepared by this process possess good keeping properties, and, when once their preparation is clearly understood, there is a certainty in their turning out satisfactory. The manipulation here described is in substance the same as published by me three years since; but the most difficult and intricate portions of that process have either been modified or omitted, so that the amateur will, it is hoped, readily understand and successfully carry out the remaining portions.

When the picture is larger than 12 × 10 inches, glass plates become very heavy, a dozen or two being a serious addition to the weight of the camera: therefore we turn to paper as a substitute; and if boldness and artistic beauty is desired we lose nothing by the change; if minuteness or sharpness is the only charm in the photographer's eye, then it will not be satisfactory; but many of the large pictures taken by paper negatives in the best exhibitions are not disgraced by comparison with those from glass.

The Calotype process is the one I recommend; it is still worked in the same manner as when first introduced by Mr. Fox Talbot; and when the paper is good, the chemicals and measures clean, failures cannot arise; the iodized paper will keep indefinitely, but requires to

be exposed soon after it has been excited. For this reason the Wax Paper process has been employed: but there troubles begin; it requires a longer exposure, and success depends on a number of minute points that are only acquired by practice; its only merit lies in its keeping qualities.

In Chapter II., on Stereoscopic Pictures, reasons have been given why the separation of the stations should not exceed a certain limit; and it will be found the production of these charming double-pictures involves no more mechanical difficulties than are met with in ordinary landscape views, while the portability of the apparatus brings it within the reach of those to whom a heavy load would be a serious inconvenience, if not an entire prohibition. I cannot quit this portion of the subject without drawing attention to the capabilities of the Tannin process for the production of stereoscopic transparencies. Whatever faults we may hereafter chance to find recorded against this process, which in its present novelty we little dream of, there can be no doubt of its suitability for printing purposes: the facility of preparation, and the splendid tone and colour of a Tannin picture, renders the satisfactory production of transparencies almost easier than paper prints. Of their permanency there can be no doubt; they undergo no change, unless a chance fall should send them into a thousand atoms; and even paper pictures, if they do not break or fade, certainly will soil; the same care that protects them from injury would preserve a glass positive; and amateurs with energy ought never to be satisfied until they have their best productions printed in this manner. The only drawback is that negatives, as generally taken, are too intense; but when the rage for harshness, or hardness, or splendid intensity (as it is variously called), has passed away, and negatives of a similar character to those well-known instantaneous stereograms of Mr. Wilson's are more sought after, there is no doubt but that transparencies will have their day.

Photography also offers facilities to amateurs for making views suitable for use in the Magic Lantern. I have been, and am now, largely engaged in the preparation of series of views suitable for public exhibitions; but as a commercial undertaking I do not think they will ever pay or be worth attention. There is no question that, for fine effect, hand-drawn and painted views bear the palm; but photography gives the unskilful draughtsman an opportunity of making his own

pictures in a far easier and better style than any other, therefore I have considered it advisable to give such directions for their production as are requisite.

In enumerating the different apparatus required, it is to be understood that some few of the articles described are not absolute necessaries, but they all will be found positively useful, and that in so many ways as to render it advisable to have them in readiness. To those who may be disposed to turn their attention to this subject, and have any doubt as to their being able to succeed, practical instruction may be had at my establishment, where I have a glass room and conveniences for the elucidation of the principles and theory of the art.

CHAPTER I.

Apparatus for Landscape Photography.

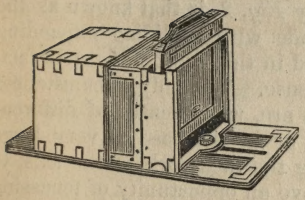


Fig. 1.

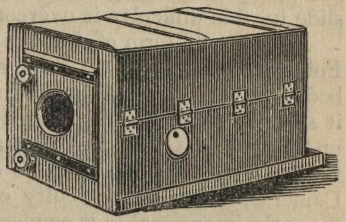


Fig. 2.

Differences of opinion are not uncommon among Photographers, but on no point are there such dissensions as in the choice of a Camera for Landscape purposes. This arises, not from any prejudice or want of judgment, but from the difficulty of meeting all circumstances under which they are to be employed. Out of the number of patterns and designs which are at present manufactured I shall mention three, which embrace in themselves the principal points that are claimed by other more complicated, and therefore dangerous, constructions. And what can be more suicidal than to have a light drawing-room piece of furniture, the sides of which are agitated by a gust of wind, and spoiled by every drop of rain? Nothing more conduces to a satisfactory Photographic trip than a calm and even mind; and can this be maintained whilst carrying a Camera as large as a Punch-and-Judy show, or fretting whilst your pet *toy* is decaying with the damp or broiling sun? Besides, these extremely minute playthings generally have a weak point when put to the actual test, or, possibly, some of their multitudinous parts have been forgotten and left at home, or in the stubble-field where last used.

The Cameras, then, which I recommend for Landscape purposes are either solid mahogany, with a sliding body, similar to *Fig.* 1,

A Folding Camera, similar to *Fig.* 2,

A Bellows Camera, similar to *Fig.* 3.

The solid mahogany Camera (*Fig.* 1) is undoubtedly the most firm, durable, and convenient in many respects, but it is comparatively bulky, heavy, and, when of a large size, inconvenient as a travelling-companion. This, however, is not a matter of the importance it at first may seem,

when the operator is employing the *wet collodion* process ; for the number of articles that must of necessity be carried about renders a conveyance indispensable, and a little extra weight does not, in this case, much signify: besides, the Camera will answer as a packing-case for many of the lighter articles.

These Cameras, when of a large size, say for plates nine inches by seven, or upwards, are generally made with a jointed tail-board, on which the inner body slides, so that it may be turned up against the back of the Camera, similar to the Bellows Cameras afterwards to be described. The focussing glass is also a great nuisance when travelling, and always liable to get broken, but, by having an extra groove for it to slide in, this difficulty is overcome.

The second form of Camera, shown by *Fig.* 2, is that known as the Folding Camera; these need not be made with a sliding expanding body, as no increase of portability is gained in that construction; in fact, it slightly increases the weight and expense. The only circumstances under which it can prove an advantage are, when lenses of different focal lengths are likely to be employed, or in the case of very large Cameras, where the difficulty of reaching the rackwork of the lens, to focus the image, makes it convenient to have an opportunity of focussing by the sliding body: in all other cases, it is rather worse than useless.

The front of these Cameras slips in a groove at one end, precisely similar to the manner in which dark slides fit into ordinary Cameras; and when this is removed, it will be apparent, from a consideration of *Fig.* 2, that the two sides, which are jointed on the outside, must close in, and the whole lies perfectly flat; the dark-slide focussing glass, together with the Camera, forming a package about two and-a-half inches thick, and will travel very safely and conveniently in a portmanteau or leather case. When required for the Dry process, they may either be had with extra double backs, to carry the sensitive plates, or the plates can be taken in a plate box, and transferred to the dark slide by the aid of a changing bag.

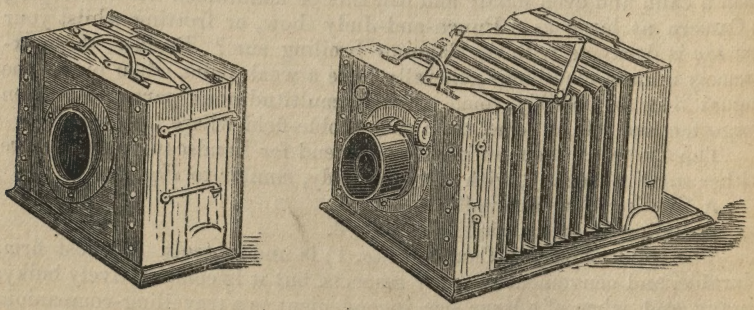


Fig. 3.

The Bellows Camera (*Fig.* 3) is lighter, and packs into a smaller space than either of those previously described; it consists of a mahogany rigid box supporting the lens. This box is fixed on a bottom board, for the purpose of carrying another frame at the further end, in which the dark slide is fixed; the space between is made with an expanding or leather-bellows body, similar to an accordion. They can be made perfectly rigid, when drawn out by means of light brass rods, with tightening screws; the bottom board folding up at the back renders it a neat and portable piece of apparatus, and also very serviceable, if used with ordinary care.

Fig. 4.

Lenses for Landscape Photography.

The Lens recommended for general purposes is the single achromatic. Long and general experience proves that, for most purposes, it is practically a good lens, taking clean, vigorous pictures, free from flare: they are mounted either with rack and pinion adjustments, or in sliding tubes. When using lenses of this description, it will be requisite to employ a stop or diaphragm, to curtail the amount of light; and as many operators are not aware on what principle to regulate the different size stops, it will be advisable to remember that the smaller the aperture the longer will be the exposure in the Camera of the sensitive plate; but, at the same time, the general definition of the picture will be improved, and objects at different distances from the Camera will be in better focus. For example, fit your Camera on the stand, insert a diaphragm of three quarters of an inch diameter, and focus for an object, say ten yards off, at the same time observing the appearance of another object at twenty yards distance; then alter the diaphragm to one of half an inch aperture, when both the objects will be sharper and better defined than either of them were before; but in a dull light, or in photographing a subject with dark shadows, the larger size stops must be employed. In this respect practice will alone teach the exact allowance which it is advisable to make, remembering that, with the same light, a diaphragm of half an inch aperture will require the exposure to be twice as long as you would give to the same lens, and under the same conditions, when using a stop with an aperture of three quarters of an inch.

The position of the stop is also a matter of some considerable importance. The general plan is to fix it at a distance in front of the lens equal to the diameter of the lens, this being considered the best compromise between two difficulties. It is a well-known fact to all who have used the single achromatic lens, that it distorts the marginal lines to a very considerable extent: this can be remedied in some degree by pushing the diaphragm in (closer to the glass), but, in doing so, the curvature of the field is increased; that is, objects in the margin of the picture will be far from sharp, owing to their coming to a focus before they reach the focus screen. The Photographer, therefore, has his choice between two evils, and must balance one against the other. The rules are these:—

To get objects situated at different distances into correct focus, it is necessary to use a small stop and give a long exposure.

To obtain a flat field, the stop must be kept as far from the lens as possible.

To reduce distortion, the stop must be as close to the lens as possible.

The best average distance is about one-fifth the focus, or nearly equal to the diameter of the glass.

The construction of the Lens is shown by *Fig.* 4.

The second form of View Lens in use is termed the *orthoscopic*, the name indicating straightness of lines; but this is a mistake, for, although the distortion is of an opposite character to that of the common View Lens, it is of so considerable an extent as to render it very undesirable for architectural purposes, the marginal lines being bent outwards, instead of leaning in, as is the case with the single achromatic. It consists of two achromatic combinations, of a somewhat similar character to those in the Portrait Lens, the back combination possessing spherical aberration of an opposite character to the front lenses, thereby correcting each other, and allowing a larger stop to be employed. Thus the lens is quicker than the single achromatic, owing to its working with a larger aperture, but that is nearly the only recommendation I can give it.

For strictly view purposes, the only other form of Lens is the *Triplet*. It has been coming into more general use during the last twelve months, and, under various names, is constructed by several makers. It primarily consisted of two achromatic combinations at the extremities of a brass tube, with a concave or dispersing lens between them. These two lenses were made symmetrical; but that is not an essential point, and, for some purposes, it is expedient to construct them with lenses of different powers and size. By removing the concave lens, the remaining combination works as a very fair Portrait Lens, especially for groups in the open air. They are generally made with stops, that are inserted through the body tube, similar to *Fig.* 5, in order to avoid the necessity of unscrewing the glasses every time an alteration in them is required.

Fig. 5.

LENSES FOR PORTRAITURE OR INSTANTANEOUS PICTURES.

The lenses previously described are not suitable for producing pictures where rapidity of exposure is of importance, owing to the absolute necessity of employing a small stop to correct the spherical aberration and flatten the field. The ordinary Portrait Lens will work with a full aperture, and is the correct form of instrument to employ. Its construction may be better understood from a reference to *Fig.* 6. A combina-

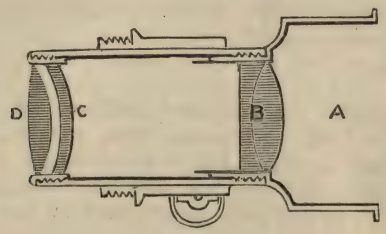


Fig. 6.

tion of two cemented lenses, similar to those in the single achromatic (*Fig.* 4), are placed with their convex surface outside, as shown by B in the diagram. The back or posterior lenses are not cemented together, but separated by a slight space, the lens D being a crossed convex; the other, C, is a meniscus concave. Pictures can be taken with this instrument in the minute portion of a second, where the full aperture is employed; but, in such cases, the want of depth of focus, and the excessive curvature of the field, prevents their use, except for single portraits occupying only the centre of the plate. By inserting stops between the lenses B and C, the depth of focus is considerably increased —of course, at the expense of rapidity; but they are then available for many landscape purposes, and are more rapid than any other known combination. The stops, of different sizes, may be inserted through the jacket tube, without unscrewing the glasses from the mounting, if required.

Most Portrait Lenses can be made to adapt for both Landscape purposes as well as portraiture, by removing the back combination and

reversing the front lenses in their cell, so as to place the flat surface outside, with a stop inserted in front, in the usual manner; it is, in fact, then precisely similar in principle to *Fig.* 4.

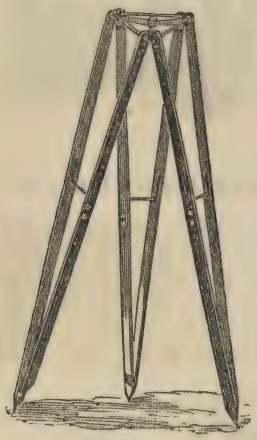


Fig. 7.

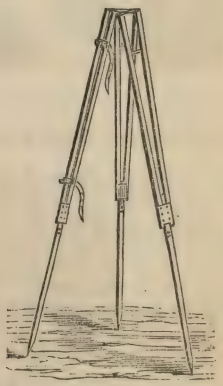


Fig. 8.

A portable form of Camera stand is shown by *Fig.* 7; it consists of three legs jointed at the bottom; and, when opened out, fitting into a metal triangular top. *Fig.* 8 represents a jointed stand well suited for stereoscopic or small Cameras: when unshipped and strapped together, it measures twenty-nine inches long by one and a half inches square.

The apparatus requisite, then, for Landscape Photography, if the operator is desirous of practising the Dry process, is a Camera, Lens, and Stand; also extra dark slides to hold the prepared plates, or else a changing bag to transfer them from a plate box to the dark slide, as required. The simplest thing is a large bag to throw over the head and shoulders, clinging round the waist by means of an elastic band. They are made very soft and light, of India-rubber cloth, and cost about fifteen shillings.

The apparatus suitable for stereoscopic purposes will be described in Chapter II. There are also numberless small pieces of apparatus and conveniences that are enumerated in photographic catalogues, or which will be mentioned when describing the manipulation of the different processes.

CHAPTER II.

Apparatus for producing Stereoscopic Pictures.

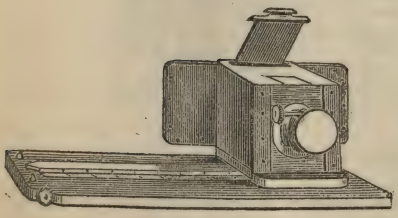


Fig. 9.

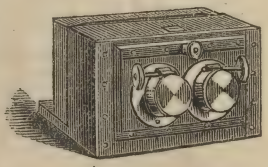
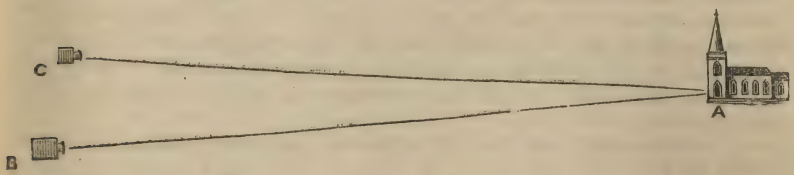


Fig. 10.

The Stereoscope affords to the Photographer the means of producing, with a small apparatus, effects which otherwise would involve the necessity of a cumbersome Camera, and the increased difficulty resulting from the employment of large plates. The pictures for the stereoscope consist of two views of the same object taken from different points of sight, as will be illustrated by the following diagram:—



Let *a* represent an object which is required to be photographed; place your Camera at a convenient distance from it, say in the position marked *b*, and obtain an impression on the sensitive plate: then remove the Camera to the left, in the position marked *c*, and take another picture. When these are mounted, and viewed by the stereoscope, they will appear to stand in relief, or convey the impression of solidity.

The Stereoscopic Camera is made in two forms; one, termed the Single Lens arrangement (*Fig.* 9), simply consists of a Camera mounted on a wooden bar, so contrived as to allow it to be shifted from one end

to the other; and, at the same time, by means of a circular motion on its axis, to have the lens always directed towards the same point: the dark slide, which carries the sensitive plate, is long enough to hold a glass, on which both pictures are taken. This frame also slides from right to left, in a groove, so as to bring the opposite ends of the glass plate at different times before the lens.

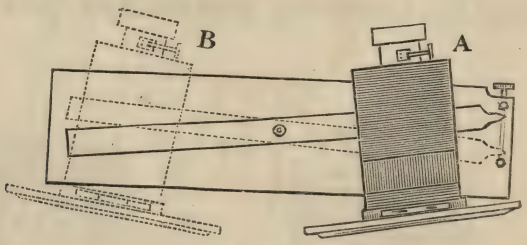


Fig. 11.

Fig. 11 shows the arrangement, where A represents the position of the Camera whilst the right hand picture is being taken, and B the second station. This principle is not scientifically correct, but has been much employed in consequence of the great amount of stereoscopic effect which it gives to the view; in fact, an exaggerated effect, which is very popular among amateurs and others, who are not disposed to scrutinise too closely the reasons why they are pleased.

The Twin Lens Camera, as represented by *Fig.* 10, is now more generally used; the lenses are fixed at a distance of two and three quarters to three inches apart, and with their axis perfectly parallel: sufficient stereoscopic effect is by this means obtained, and the views are seen without fatiguing the eye, as must be the case with those taken on other principles. A great merit of this arrangement is, that both pictures are taken at once; and so great an advantage is this, that objects which move, or are likely to move, can be taken in no other possible way.

A portable form of Camera, with the Single Lens arrangement, is shown by *Fig.* 12; the camera, lens, six or nine dark slides, as required, the top of the stand, and focussing screen, packing into a box eleven inches by nine inches, and seven inches deep, the whole of which will weigh under eight pounds.

To use this Camera, first fix the box on the top of the stand, by means of the nut and screw furnished for the purpose; then place the Camera on the rod which fits the top of the box; this rod turns on its centre similar to *Fig.* 11: now slide the Camera to one extremity of this bar, say in the position B, and focus for the view, observing the position which some prominent object occupies, by the aid of a few vertical lines which are ruled on the ground glass; then slide the Camera to the

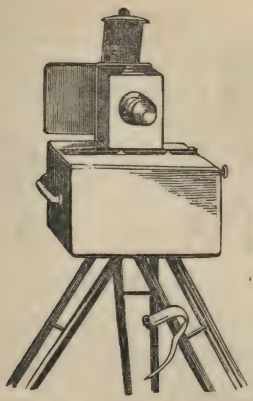


Fig. 12.

right, say in the position marked A, and having given the bar as much rotary motion as the guide-screw will allow, see that the same objects in the view fall upon the ground glass, which is readily done by the aid of the vertical lines previously alluded to: should they not do so, the bar has too much or too little motion on its axis, and requires adjustment by the screw provided at the end for this purpose. When the Camera can be shifted from end to end, and the same objects fall upon the same spot of the focus screen, all is ready; therefore again place the Camera on the right-hand side, and insert a plate-holder containing the prepared glass: remove the brass cap which covers the lens, and give it the necessary exposure; then replace the brass cap on the lens and slip the Camera along the bar *to the left*, and also slide the plate-holder containing the plate *to the left:* remove the cap again, and expose for the other picture, after which the plate is ready for development.

In using these Cameras, care must be taken to close the dark slides or shutters, previous to removing the plate-holder from the Camera; also remember that the plate-holder must be moved from right to left, *or in the same direction as the Camera;* else a pseudoscopic effect is produced.

No particular directions are required for the use of the Twin Lens Camera, the focus being obtained in the usual way, by sliding the back either in or out, or by means of the ordinary rackwork adjustments: they are made in various ways, to suit the exigencies of the operator. The form lately introduced by me is, in my opinion, as good as any other, and better than many: it has no delicate bellows body to get out of order, is portable, and can be put into use with less trouble than any other which I have seen. *Fig.* 13 is a representation of it when fixed on the stand ready for use; the Camera, with three double backs,

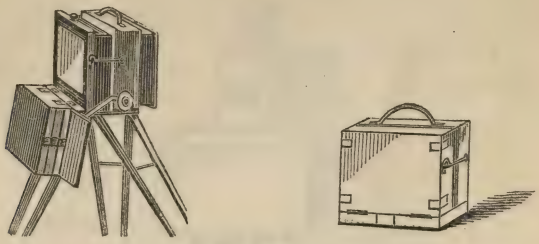


Fig. 13.

carrying six plates packed for travelling, weighs under three and a half pounds, and, being all mahogany, will not suffer if a few drops of rain should happen to fall on it. The lenses are brought to focus by moving the front partition out and in, by means of an endless screw, working by a handle placed for convenience at the side of the Camera. The dark slides pack into a small box, jointed to the bottom board, and, when in use, fall down at the back; nothing having to be removed or unpacked, the Camera simply requiring to be fixed to the stand, and all is ready for work.

The lenses employed for stereoscopic pictures are similar to those in general use; the single achromatic is the best for most purposes, and for architectural views either the Triplet or Portrait Lens, with a small stop in the centre: they should be mounted on Binocular Cameras, about two and three quarter inches to three inches apart.

The effect of taking the stations further apart than this (which is the correct theoretical distance, the parallelism of the Cameras being still preserved), is to give to the near objects the appearance of being closer to the spectator than they are, the distant objects remaining at their true position. Besides, when this distance is increased, it is necessary to direct the axis of the lenses to the same point, as shown by the Single Lens Camera arrangement (else the pictures are partly thrown outside the focussing screen); and this produces distortion, as well as fatiguing the eye, in consequence of the perspective of the horizontal lines not being on the same plane in both pictures: in such cases, it is impossible to make the two images combine without difficulty. This is not always so great as to be an inconvenience to a person accustomed to the use of a stereoscope, but is often the reason why those who look into one for the first time complain that they see two pictures.

The Single Lens Camera can be used for the production of pictures that will bear scientific criticism, if the Camera is not moved along the bar more than the theoretical distance of three inches.

The Stereoscope (*Fig.* 14), as at present made, answers almost all requirements; the lenses are prisms, or portions of a large convex glass

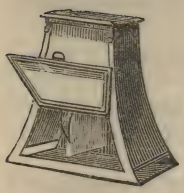


Fig. 14.

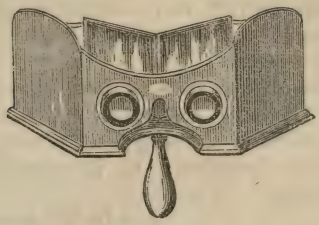


Fig. 15.

cut down, but an improvement is effected, if the pictures are properly taken, by using whole achromatic lenses, and the eyes allowed to look through their centres. A Reflecting Stereoscope (*Fig.* 15), designed by Mr. Sutton, is intended for exhibiting pictures of a larger size than those in general use, and without distortion or displacement. The views are four inches square, and show the objects of their natural size and at their correct distances: it is essentially an amateur's instrument, but certainly gives a remarkably good effect. The focus of the Camera lenses with which these pictures are produced should be six inches; and it is necessary that they are taken through the glass, or with the collodion film next the back shutter.

Stereoscopic pictures are generally printed on highly albumenized paper, and mounted on buff or drab cardboard, with starch, clean glue, or dextrine; when printed from a negative taken by a Binocular Camera, they require reversing before they are mounted; but by far the most effective of all are transparencies on glass, produced by printing on a plate prepared by the Tannin process, Chapter XIII.

CHAPTER III.

Collodio-Albumen Process.

This beautiful process, first published by Dr. Taupenot, in the autumn of 1855, possesses many advantages over any other preservative method that has yet been known; the extraordinary amount of detail and certainty of success has, to a considerable extent, led to its popularity. Since it was originally given to the world, there have been many modi-

fications, which have added to its simplicity, and in the following directions I have given the process as free from superfluous manipulation as possible.

The process may be divided into eight operations, viz.:—

1. Cleaning the Plate; 2. Coating with Collodion; 3. Sensitizing the Collodion Coating; 4. Coating with Albumen; 5. Exciting the Albumen Solution; 6. Exposure in the Camera; 7. Developing; 8. Fixing.

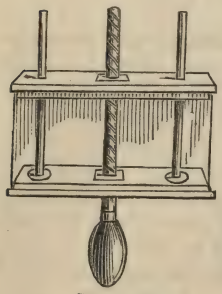


Fig. 16.

In all branches of Photography, Cleaning the Glass is one of the most important points; but, in this process, as the film, after having been dried twice, and again moistened to develope, has an inclination to rise in blisters, especial care should be taken to have as pure a surface as possible. When the glasses are new, or if they have been used before, and the film allowed to dry on them, they require thorough cleansing, for which purpose, if of a large size, a plate-holder is required. One of the best forms is shown by *Fig.* 16.

The Plate is laid on this, and clamped tight by aid of the screw; then rub the surface with a small bung or cork, covered with a piece of chamois leather, using a mixture of tripoli, nitric acid, and water, say:—

Tripoli*	½ ounce.
Nitric Acid	1 drachm.
Water	2 ounces.

Afterwards rinse it in clean water, and wipe dry with a linen cloth; then polish well with a wash-leather that has been washed, to free it from the dressing used in the manufacture. By breathing on the glass the surface may be more readily seen; and if smears are visible, wash and clean the glass again, but on no account touch the surface with the hand after it has been polished. The readiest way will be to clean a stock before commencing operations, and stand them by in a plate box until required.

Preparation of the Collodion.

The best Collodion for this purpose is one that, when dry, presents a fine granular surface, and not glutinous or reticulated; the sensitiveness of the Collodion not being a matter of moment, old useless negative

* Various detergents are now sold for this purpose, and save a great amount of trouble, but some of them are liable to injure the bath. I can, however, confidently speak to Fisher's Glass Polish as being a safe article to employ.

Collodion may generally be employed, by adding three or four drops of pure rectified ether to the ounce; but, in default of this, use a thin iodized Collodion, in which a slight quantity of iodine has been added. I supply a Collodion for this purpose, called "Prepared Iodized Collodion for the Dry process." The formula for making a suitable preparation is:—

Pyroxyline	45 grains.
Absolute Alcohol	3 ounces.
Absolute Ether	3 ounces.

When thoroughly dissolved, add two ounces of iodizing solution, made thus:—

Absolute Alcohol	2 ounces.
Bromide Ammonium	16 grains.
Iodide Cadmium	60 grains.

The pyroxyline should be of that character which leaves a powdery film; if that is not the case, add a drop or two of chloroform to each ounce, and after a few days it most likely will work right.

The plates are coated in the usual manner, but they must be *thoroughly dry* previous to the Collodion being poured on. They ought not to be sensibly warm, but it is advisable to perform this operation in a room free from damp; to prevent repetition, it must be remembered, that the greatest difficulty that has to be overcome in this process is the tendency to blister which the film has, and for this reason I should not recommend breathing on the plate previous to coating, as is frequently done: if you are sure the glasses are clean when put away in the plate box, it is only necessary to wipe off the dust that may have settled on them with a dry leather.

When the Collodion has had time to set, the plate is to be immersed in the nitrate of silver bath, in order to

Sensitize the Collodion Coating.

The bath is thus made:*—

Solution A.

Pure recrystallized nitrate of silver	8 drachms.
Distilled water	$2\frac{3}{4}$ ounces.

Solution B.

Iodide of potassium	2 grains.
Distilled water	2 drachms.

* Instead of using this aceto-nitrate bath for the first sensitizing, the ordinary negative bath may be judiciously employed.

When this is dissolved, pour it into the silver solution A, stirring the whole time with a glass rod, to insure perfect mixing; the precipitate of iodide of silver that was at first thrown down will almost immediately redissolve, and the solution will be at once bright and clear; then add:—

Distilled water.....	12 ounces.

Shake well up and filter, to clear from the fine precipitate which is again formed, when it will require to be filtered two or three times through the *same* filtering paper: afterwards add:—

Glacial acetic acid	6 drachms.
Kaolin.....	3 drachms.

Keep this solution in a stoppered bottle.

When required for use, filter a sufficient quantity into a gutta percha or glass dipping bath, and it is ready. The glass plate that has been coated with Collodion is to be placed on the dipper, which is supplied with the trough, and immersed steadily into the solution, where it should remain from one to two minutes, or until the greasy appearance is removed.

When taken from the bath, lay it face upwards on a levelling stand, and pour over the surface sufficient *distilled* water to cover it, then wash with a good stream of pure soft water for several minutes, in order to remove the nitrate of silver solution: this requires to be very carefully and thoroughly done, or marks will be left in the film. Drain off the water, and, whilst still wet, it is ready for the fourth operation, viz.:—

Coating with Albumen.

Iodized albumen is prepared by mixing albumen with the bromide and iodide of potassium. Take three *new-laid* eggs, and carefully separate the yolk from the white, which only is to be retained; this will be found to measure about three ounces, and should be put into a small basin or measure, and well beaten into a froth with a silver fork or bundle of quills; then pour it into a four-ounce bottle, and after a few minutes the froth will partially subside: now add the following:—

Distilled water.....	1 ounce.
Iodide of potassium	16 grains.
Bromide of potassium	2 grains.
Pure iodine	½ grain.

These are to be dissolved in the water in the order given, taking especial care not to add too much free iodine, or it will coagulate the albumen. Pour this iodizing solution into the albumen, and shake it well up for two or three minutes: afterwards add:—

Liquid ammoniæ ..... 20 drops.
Glycerine ..... ½ drachm.

Albumen being too thick and glutinous to readily pass through filtering paper, a small piece of sponge, lightly pressed into the neck of a glass funnel, will be a convenient substitute. Let the albumen filter several times, until it is clear and limpid; then take the moist plate, from which the silver solution has been completely removed, and pour over the surface the iodized albumen. When the plate is evenly covered, drain off the superfluous quantity into a separate measure, and again coat it with a fresh supply. An instrument called an Albumen Filter (*Fig.* 17) is very convenient for this purpose. It is used thus:—A small piece of sponge, well washed, is placed in the bottom part of the large end of the filter; press it lightly down, and pour the albumen on the top of the sponge so as to nearly fill the glass; in a few minutes it will percolate through the sponge and rise in the small tube, from which it is to be poured on the plate. After it has spread evenly over the surface of the wet collodion, the superfluous quantity may be drained back into the large, bell-mouth end of the filter, and by this means a constant supply of fresh-filtered albumen is always at hand. When an even film of albumen has been obtained, free from floating particles or air-bubbles, they are to be carefully dried. In drying the plates, let them stand on several sheets of clean blotting paper, with the top of the plate touching the wall only at one corner, until they are drained from the excess of moisture. It is expedient to finish them off by artificial heat, and nothing can be better than a common oven, the plates standing on a tile or brick, with their upper corner resting against the side; when *thoroughly dry*, they may be stored in plate boxes ready for the next operation. Up to this point they will bear exposure to daylight without apparent injury; therefore these operations may be conducted in any room where there is not a great excess of light.

Fig. 17.

When required for use, they are to have the

Albumen Coating Excited

by immersion in the aceto-nitrate bath, as before used for exciting the collodion film (see p. 21). The plate will require to remain in this bath for about one minute, when it must be withdrawn, and again placed on a levelling stand; the screws underneath are to be carefully adjusted, so as to procure a level surface, and a small quantity of *distilled* water poured over the plate, after which a much larger quantity of common soft or rain-water is to be used, in order to remove all trace of nitrate

of silver: unless this is well and carefully done, the plates will, to a certainty, be spoiled. The deposits of nitrate of silver that are formed in drying produce a number of marks or feathers, which appear afterwards in developing the picture; therefore the water should be poured not only over the centre, but also round the sides and in the corners.

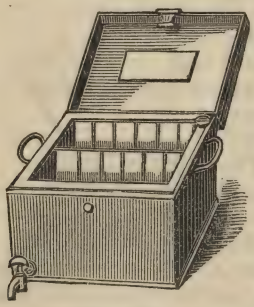


Fig. 18.

It remains to finally dry them off, and they are ready for exposure. A Drying Box, which we have introduced for this purpose, is represented by *Fig.* 18. It consists of a double-lined case; in the inner one the plates are reared up, with their ends resting on wires placed to receive them: the lid closes down light-tight, and ventilation is provided for by an opening in the top. Being sensitive to light in their present state, every precaution must be taken they are not subjected to it in any way. When dry, they are to be stowed away in light-tight cases. The safest plan is to keep them in tin plate boxes, which are perfectly impervious to light, and do not injure the plates by vapour, which most wood boxes are said to do, if they are kept any length of time.

Exposure in the Camera.

The plates may be exposed either immediately they are dry, or kept two or three weeks, if required. The form of Camera best suited for the purpose having been selected, the plates are put into the dark slide by the aid of a changing bag, into which the head and shoulders of the operator are inserted, unless the Camera is provided with a number of separate backs or dark slides, when, of course, the plates are placed in them previous to leaving home.

The time of exposure is not of so much importance; for the development may be modified to rectify any little error; but, as a general rule, about four times that required for wet collodion negatives will be found sufficient; with a stereoscopic lens of four and a half inches focus, and a one-eighth inch stop, in the shade, from four minutes and a half to five minutes; but, in the sunshine, half of this time will be ample; and, with a lens of fourteen inches focus, and an aperture of half an inch, in the summer sunshine, from seven to ten minutes. After the plate has been exposed the necessary time, the brass cap is replaced, and the dark frame containing the collodion plate removed from the Camera (taking care to close the wood shutter); they are then ready for

Developing,

which may be done at once, or deferred for several days. The best solution for this purpose is a mixture of gallic acid and nitrate of silver. Take

Gallic acid.....	3 drachms.
Distilled water	12 ounces.
Glacial acetic acid	½ ounce.

Put this into a stoppered bottle, shake the whole well up, and let it stand a few hours in a warm room or before the fire, in order to dissolve as much acid as possible; but there will always remain with the above proportions a small quantity undissolved at the bottom of the bottle. Just previous to commencing the development of the picture, pour about half an ounce of the gallic acid solution into a *clean* measure, at the same time filtering it through paper, and add two or three drops of silver solution, twenty grains to the ounce of water.

The plate, on being removed from the Camera slide or dark box in the operating room, should be placed face upwards on a levelling stand, and a small quantity of distilled water poured over the surface, letting it remain there several minutes, in order to moisten the film previous to commencing the development. After the albumen film has been softened, the gallic acid solution should be poured over, and allowed to remain there ten minutes, when a slight trace of the picture will generally be seen. At this stage of the process the plate may be drained of the developing solution and held up to the light; by this means, on looking through the picture, you will observe if stains have made their appearance: should this be the case, they can be removed by taking a small piece of cotton wool and carefully wiping the albumen surface; then wash the plate with a gentle stream of soft water, and apply the developing solution again, adding twelve or fifteen drops of the silver solution to the gallic acid: after a time the plate will have acquired the requisite amount of density, when the further development is stopped by washing with a stream of pure water, and should be again thoroughly examined. Any slight deposit on the surface may possibly be removed by wiping the film with a piece of *clean* cotton wool, and afterwards well washing with more water.

The time requisite for development will vary very considerably, depending on the amount of exposure the plate has had; but, as a general rule, from twenty minutes to three quarters of an hour will be sufficient; this time may be materially reduced by adding to the gallic acid solution a few drops of the ordinary pyrogallic acid developing solution, as used for wet collodion negatives, but not until after the picture has begun to make its appearance, as with a rapid development there is a disposition to stain the film: however, it is often very convenient to be enabled to force a picture out, especially in cold weather, or when the plate has not been sufficiently exposed.

The appearance of the negative will soon determine if the proper exposure has been given to the plate or not: if it does not present the proper contrast of light and shade, but is of a uniform dull colour, the sky being too transparent, and the details indistinct, the time of exposure in the Camera has been too long; but, in an under-exposed plate, the sky is very opaque, while the dark parts of the picture are entirely without detail, and, in the printing process, will only produce blacks and whites, without half-tones.

Perhaps the most simple method will be, before starting on a tour, to expose a plate in a moderate light, say three minutes, and develope it; then expose another in the same Camera immediately afterwards, allowing six minutes: the comparison between the two will afford the experience necessary. I have found, as a rule, that most failures arise from under-exposure. This process seems, in my hands, as rapid as most others of a similar character; but seldom have I spoilt a picture from giving it too long in the Camera: and undoubtedly there is an advantage to err in this respect, for, in developing, if the image seems to be coming out too rapidly, it may often be saved by using a weak developer, made with gallic and citric acid, while a thoroughly under-exposed plate can never be sufficiently intensified.

If the developer turns thick before the image is thoroughly brought out, it must be thrown away, and a fresh supply obtained, *previously washing the measure that contained it;* and on no account return any that has been used into the new solution. The value of the gallic acid is so very trivial that it is not wise to practise extreme economy in its use; a single drop that has been on the plate will cause the contents of a large bottle to speedily decompose.

Instead of placing the plate on the levelling stand, it may be laid in a shallow glass pan, and the developer poured over it; but I do not recommend this, as the dirty solution is not so readily removed as in the former method.

Fixing Solution.

In a wide-mouthed bottle, make a saturated solution of Hypo-sulphite of Soda. The fixing solution is poured over the plate until the semi-opaque yellow film is removed, when the process of washing must be again performed. The washing water has a tendency to get between the film and the glass; therefore care must be taken to hold the plate level. I recommend Hypo-sulphite of Soda in preference to Cyanide of Potassium for this reason: the iodide, being in the comparatively hard albumen film, is somewhat difficult to remove; and cyanide eats away the delicate portions of the negative before it has had time to perform its work. There is no doubt Hypo-sulphite of Soda is preferable for negatives in *all* cases.

The hardest and most durable varnish is made with spirit, and

requires the plate to be moderately heated before it is applied ; then it can be poured over in the same manner as collodion. For amateur purposes, chloroform and amber varnish is suitable ; it dries without heat, and is sufficiently durable.

CHAPTER IV.

Fothergill's Process.

The advantages claimed for this process are chiefly that the plates can be quickly prepared, and without employing different chemicals to those in common use for wet collodion negatives ; whilst its defects arise in most instances from the uncertainty in manufacturing collodion possessing the same characteristic properties. The success or failure of this process depends almost entirely on the amount of washing the plate may have after its removal from the bath. Some collodions yield an extremely porous film, whilst others are of a hard, horny nature ; therefore one will part with the excess of silver more readily than the other. This subject will be further treated on in summing up the causes of failure at the conclusion of the chapter.

The manipulation is more simple than the Collodio-Albumen, inasmuch as the second immersion in the bath is dispensed with. A synopsis of the process shows five operations to prepare the plate for exposure :—viz. Coating with Collodion, Exciting in the Bath, Washing to remove the Excess of Silver, Flooding the Film with Albumen, and Final Washing, to remove its excess.

The Collodion

employed may be the same as that recommended for ordinary purposes. A formula for its manufacture is given in Chapter IX. ; but it should have been iodized some considerable time previous to being used. In fact, old collodion is *the thing* for all Landscape purposes, except when extreme rapidity is required. There are, of course, exceptions even to this rule, for some manufacturers so prepare their collodion that it becomes useless after it has been iodized a few days. In these cases it must be used fresh, but produces black and white pictures that may do for portraiture in a feeble light, but is useless for good operators in the open air.

The Silver Bath

is precisely the same as would be in general use, either thirty or forty grains of silver to the ounce of water, rendered slightly acid with acetic acid.

Albumen Solution.

Albumen	3 ounces.
Distilled water	4 ounces.
Liquid ammonia	10 drops.
Phosphate of soda	4 grains.

Put it all into a bottle, and shake well up until completely frothed; then filter through paper. There will not be much difficulty in doing this, owing to the albumen having been so much diluted; and the quantity of water may be still further increased, if desirable. The ammonia is for the purpose of keeping the solution sweet, and, by breaking up the membranes in the albumen, adds to the facility of filtering.

Developing Solution.

Pyrogallic acid	3 grains.
Distilled water	2 ounces.
Citric acid	1 grain.

Previous to applying this, add ten drops of a twenty-grain solution of nitrate of silver to every half-ounce of developer.

Fixing Solution.

Saturated Sol. of Hypo-sul. Soda.

Manipulation.

The Preparation of the Plate

is, of course, to be on a clean glass; and it is advisable to well roughen the edge of the plate, to prevent the film from slipping. When the plate has been immersed sufficiently long in the bath, it requires washing, to remove the nitrate of silver solution; and this is rather a vexed question. In fact, it is the crisis of the process, and either makes or mars the picture; as before mentioned, it depends on the nature of the collodion. I proceed thus: after the collodionized plate is taken from the bath, either place it on a levelling stand, or hold it by a pneumatic holder as near level as possible; pour on just sufficient distilled water to cover it all over; and after that has been on about a minute, drain off and apply a second dose; this in its turn is thrown off, and a small quantity allowed to flow over in a gentle stream.

By this time the principal portion of the silver has been removed; but as it is essential to have a definite quantity on the film to enter into combination with the albumen, I then immerse it in another bath, containing a weak solution of silver, say five grains to the ounce; raise the plate up and down two or three times, to get rid of the greasiness which is at first produced; and then pour over the wet plate the albumen solution, using just sufficient to evenly flood it all over; and, after standing a few minutes, drained off into the sink and thoroughly washed with a running stream of water, they are then to be dried and preserved from the light until used.

The Exposure

may be a trifle less than in the Collodio-Albumen process, or about three times that given to a wet collodion negative.

The Development

should be performed as early as convenient after the plates have been exposed, but it is not advisable to keep them many days; using the pyrogallic and silver solutions, as described on page 28, mixed in the proportions there given, at the time they are wanted, and in a *clean measure*. The film is first wetted with distilled water, and then the developer poured over in the usual manner: sometimes it is much discoloured in a few minutes; if so, throw it away, wash the plate, and with a fresh supply start again.

The details of the negative ought to appear in five or ten minutes, and sufficient intensity obtained in half an hour; but I have known instances where, from under-exposure, the image has taken one or two hours to develope, and turned out, after all, a fair negative; but such extremes are very rare.

Glacial acetic acid may be substituted for the citric acid in the formula of developer given at page 28, when the light is not very intense or in cold weather. After the picture is fully brought out, it is washed and fixed as usual. Further intensity may be gained by a second application of the developer or by the process in the Appendix; but I have never seen a plate taken by this process that appears to have the same intensity as wet collodion yields; but the peculiar green colour of the film in all cases where albumen is present obstructs the light to a great extent, therefore there is no necessity to strive for extreme density.

The difficulties that are incipient to this process have already been hinted at. The principal are, deficiency of vigour, and markings of an eccentric character, which often baffle every reasonable conclusion: they arise principally from the silver which is left on the plate entering into combination with the albumen coating.

If the plate has not been sufficiently washed, the image developes very rapidly, with a red tone, and, at first, possesses good contrast of light and shade ; in fact, all appears to be progressing favourably ; but before the density is deep enough to be stopped, stains and spots make their appearance in every variety of form, arising from the irregular reduction of the silver, and possibly from the partially coagulated lumps of albumen ; therefore it is advisable to wash the plate as much as the particular collodion will bear. On the other hand, if the silver has been too thoroughly removed, the image developes very slowly, is quite deficient in contrast, being of a uniform colour, and, before the requisite density is obtained, fogging commences all over the plate.

The remedy is to employ a washing bath with a larger proportion of silver in one case, and less silver in the other.

Care must be taken not to confound the appearances arising from these faults with those caused by over or under exposure, which are of a somewhat similar character.

The albumen solution may be made thinner than directed at p. 28. An extra ounce of water will not generally produce an ill effect, but facilitate its filtration through paper; the proportion here given is only meant as an average quantity ; eggs varying considerably in their viscidity. When the Albumen comes into contact with nitrate of silver, it is coagulated; therefore, well wash and drain the plate in one direction only. Common water will do for this purpose ; but, in the earlier stages, distilled water only must be used.

CHAPTER V.

Tannin Process.

A Dry Collodion Process has been brought into notice by Major Russell, who employs a solution of Tannin as a preservative. It appears likely to be of great value and importance, and materially simplifies the preparation of the plate ; if their keeping qualities in warm weather are established, it doubtless will become speedily popular. The peculiar advantages which it possesses are, that the plates are easily prepared, develope quickly, and of a rich red colour ; therefore they print with a good contrast, and, if not sufficiently intense, can be readily strengthened. The difficulty to be overcome is, to prevent

the film from slipping from the plate, it being remarkably tender, and therefore liable to be torn, especially in the final washing, after having been fixed with hypo-sulphite of soda, which, from its great specific gravity, is likely to float it off the glass: it, however, can be made to adhere firmly, by coating the glass with albumen or gelatine, as described in the Appendix; but, as this materially adds to the trouble, it is expedient to avoid doing so, if possible.

The details of the preparation of the plate will be fully described; but it is advisable to first understand the operations by which they are produced.

1st. The glass is cleaned, collodionized, and excited in the usual Negative Bath, in the ordinary manner.

2d. It is then thoroughly washed in an unlimited quantity of water.

3d. Whilst still wet, a solution of Tannin is poured over the plate; it is then set up to drain, and thoroughly dried, if possible, by artificial heat. They are now ready for exposure and development.

The glasses require to be roughened on the edge with a piece of hard notched wood and emery, which materially assists the adhesion of the collodion, and will avoid the necessity, in most cases, of varnishing round the edges. The Collodion suitable is of a spongy character, with as large a proportion of pyroxyline in it as can be readily worked, bromo-iodized, as recommended for instantaneous pictures, Chapter IX.

When the glasses are thoroughly dry, they are coated with Collodion, which is allowed to set until the film is most decidedly gelatinous; they are then immersed in the Silver Bath, prepared in the same manner as for wet collodion negatives, of the strength of thirty to forty grains of silver to the ounce of water. In this it remains for a full time, say four minutes, and, when removed, washed with a gentle stream of *Distilled Water*, or (what is better) laid face upwards in a pan containing the same, and afterwards *thoroughly washed* with a stream of soft water.

The simplest plan, in preparing a number of plates, is to leave the first in the pan of water, whilst collodionizing a second, and immersing it in the bath; by the time that is done, nearly all the greasiness has disappeared from the film of the first, when it may be removed and finally washed.

The preservative Solution of Tannin is prepared thus:—

Tannic acid	10 to 15 grains.
Distilled water	1 ounce.

Dissolve, and filter through paper, which it will readily pass: the precise strength of this solution is not a matter of much importance.

The Collodionized plate having been so far prepared, it must be allowed a minute to drain, and then coated with the Tannin; for this

purpose, take a fresh-made portion of the solution in a clean measure, and flow it in one wave over the plate; it thus carries before it the surplus water that may have been left from the washing, which drains off with it from the further end, the glass being held in an inclining direction for this purpose. After the lapse of about half a minute, apply a second portion of the Tannin in the same manner, letting it drain off as the first did; it is advisable to apply it again for the third time, thus insuring a perfect coating. It must be understood, from these remarks, that the object is to cover the film with a deposit or varnish of Tannic acid, without permitting the wave to recede or flow over a second time. If the plate were held level, and just sufficient Tannin poured on to cover it, the same result might be accomplished; but, by following the directions here given, the first application acts as a wash, removing the water, &c. Now rear the plate on end, to drain, and, when nearly dry, it may be finished off by artificial heat, taking the usual precautions to avoid injury from solarization by stray gleams of light: it is essential to have them thoroughly *free from moisture* when exposed.

If fears are entertained of the film washing up, and not adhering to the plate with sufficient tenacity, the edge may be varnished with spirit varnish, applied with a small camel's hair pencil.

The time of exposure is about six times that given under similar conditions to a wet collodion negative; but they appear to possess the property of withstanding over-exposure; it being almost impossible to accidentally give them more than can be modified by the developer.

Develope with—

Pyrogallic acid.....	3 grains.
Distilled water.....	2 ounces.
Glacial acetic acid	40 drops.
Alcohol.....	20 drops.

When the plate is removed from the dark slide, cover it with distilled water, when immediately it appears as if the film were cracked, from its swelling in ridges; they, however, soon go down: then pour on the pyrogallic acid developer, with the addition of a few drops of silver solution.

The development is very rapid, in about ten minutes they ought to be sufficiently intense, and, with the above developer, of a red black colour. Fix with hypo-sulphite of soda, of the usual strength, say four ounces to the pint of water.

The pictures are remarkably clean; if the collodion and bath are in good order, and produce a satisfactory result with the wet process, there is no doubt that all will be right with the Tannin preservative; stains are very rarely met with, and then arise from imperfect washing, it being requisite to remove as much of the silver solution as possible. For this purpose use at first only distilled water; all others precipitate chloride on the film.

CHAPTER VI.

Dry Collodion Process.

Dr. NORRIS'S PATENT.

If a Collodionized plate is thoroughly washed on its removal from the bath, and then dried, it still possesses sensitive properties; but the chances of success are so remote, that it is essential to adopt some preservative agent to insure a more regular reduction of the silver; hence the numberless Dry Collodion processes that have been recommended. The process patented by Dr. Hill Norris does not appear to be very successful in the hands of the amateur; but, certainly, the plates prepared and sold by him are the best in the market; and, as they can be procured in most large towns ready for exposure, this work would not be complete without a notice of them.

The directions given by Dr. Hill Norris for their use are these:—

"Preliminary Observations.

"In unpacking the plates no attempt must be made to slide them from the paper grooves, or they will be inevitably scratched.

"The plates should not be transferred to plate-boxes till the morning of their use; and the box should be thoroughly cleaned from dust some time previous to their insertion, otherwise pin-holes will result. The same holds good with regard to dust in the slides or the interior of the Camera. If possible, it is advisable not to use a plate-box at all, but to transfer the plates at once to the slide.

"To ensure the finest results, the plates should be developed within twelve hours of the time of exposure. The best mode of manipulating is, to take the plate from the slide with a pneumatic holder (applied to the back) and pour upon it distilled water, from a jug or wide-mouth bottle, to wet it all over; drain pretty closely, and then apply the developer as advised in the instructions.

"Never, when avoidable, use common or rain water to wet the plate previous to development—their action is uncertain. Let the Developing Measure be kept scrupulously clean, by washing with cyanide of potassium, and rinsing well with water, and wiping dry between each plate.

"Never place the plate on a levelling-stand when developing with pyrogallic acid, but keep in constant motion. Never expose a plate when there is the slightest mist or fog in the atmosphere, as it will

render the lights purple, and bury the picture in development; and, if under-exposed, innumerable pin-holes will occur in the blacks.

"In drying *or* warming for varnishing, do not *heat* the plate, as the film will be liable to crack in fine wormlike lines.

"DEVELOPMENT OF THE LATENT IMAGE.

"Solutions required:—

Acetic	1 drachm.
Water	2 ounces.
Pyrogallic	3 grains.
Nitrate of silver	40 grains.
Distilled water	1 ounce.

Let the plate be wetted all over with distilled water, and then set on one end to drain a little; meanwhile add (if for stereoscopic plate) four drops of the silver solution to two drachms of pyrogallic solution in a measure. Mix well with a clean glass rod or slate pencil, and then pour on to the plate at the end from which the water drained off, run it dexterously over the whole surface of the plate, into the measure again, and then pour on again at the opposite corner to the first. Keep it gently on the move. The image will now appear; but, if unequally, the solution must be returned to the measure, and poured on repeatedly at that particular part or parts till the development is equalised. When this solution appears exhausted, make a second application, containing eight drops of silver to the two drachms of pyrogallic solution. This will rapidly bring up and intensify the image; which, after washing, is ready for fixing.

"FIXING THE PICTURE.

"*Fixing Solution.*

Cyanide of potassium	5 grains.
Distilled water	1 ounce.

This operation requires some care, especially with large plates, on account of the solvent action exercised by the cyanide upon the picture. Slightly swill the plate before putting on the cyanide solution, in order that it may flood evenly over all parts of the plate. When the larger portion of the yellow iodide is removed, swill slightly, and then examine the plate at the back. If any yellow iodide remains it will at once be seen, and the cyanide should be carefully applied to this part, and swilled immediately on its removal. By this means the whole of the iodide may be removed without weakening the picture. Hypo-sulphite of soda is better for fixing, but the plate must be washed much more to rid it of all hypo-sulphite, which would crystallize on the varnished negative. The negative may now be dried and varnished. The best varnish for the purpose is that known in the market as French varnish."

Such are the instructions sent with the plates; there are two points, however, open to grave criticism. From the tenour of the remarks made on fixing with cyanide, it is evident that fears are entertained of its dissolving the picture. I have used a considerable number of these plates, but always fix with hypo-sulphite of soda. I should not recommend French varnish for preserving them, as the film will not bear the heat necessary for it. Amber and chloroform is preferable, although not so hard and durable.

Rapid Dry Collodion Plates.

In the autumn of 1860, Dr. Hill Norris introduced a modification of his process to increase the sensitiveness of the film. The plates are certainly as clean and rapid as wet collodion, but require great nicety in their exposure, which, if slightly overdone, ruins them—developing of a pale pink colour, without intensity.

The development is precisely the same as for his ordinary plates.

CHAPTER VII.

Oxymel Preservative Process.

This process consists in preserving the moisture of the collodion film by a solution of honey and acetic acid, termed Oxymel, which is floated over the surface of the plate, and enables it to be kept twenty-four or thirty hours before development; its chief merit consists in the simplicity of the manipulation and the softness of the resulting picture; it has, however, a few drawbacks, the chief of which is the moist or sticky nature of the film and the positive necessity of the chemicals (bath, &c.) being in the best working order. The sensitiveness is about the same as in the Collodio-Albumen Process, described in Chapter III., or, as a general rule, requiring four times the amount of exposure of a wet collodion negative.

After the plate has been removed from the bath, wash in two or three changes of distilled water, and, after a slight draining, immerse it in dilute oxymel, prepared thus—

Honey.....	½ pound.
Acetic acid (not glacial)	1½ ounce.
Water.....	2 ounces.

Put this into an open vessel or jar, and stand in a saucepan of boiling water, until a white scum rises upon the surface ; remóve this two or three times, when it may be allowed gradually to cool, and diluted with water in the following proportion :—

Oxymel	2 ounces.
Soft water	4 ounces.

Filter through paper into a shallow pan, into which the plate is plunged. It remains here about half a minute, and, when removed, stood vertically on blotting paper to drain ; this paper ought to be renewed several times, or when it becomes wet: of course all this must be done in a dark room, as the plate is sensitive to white light. After the plate has stood at least three or four hours to drain, it may be exposed in the Camera.

The developing solution is made, as usual, with pyrogallic acid, in the proportion of one grain to the ounce of water, and fifteen drops of acetic acid.

When about to develope the plate, it must be washed with a gentle stream of common water for a few minutes, to remove as much as possible of the preservative solution ; the developer is then poured over, previously mixing in a clean measure one or two drops of silver solution to a drachm of the pyrogallic ; the image quickly makes its appearance, and deepens in intensity. In cold weather, the quantity of nitrate of silver may be advantageously increased, or there will be some difficulty in bringing the detail of the picture well out ; and, in very hot weather, a larger quantity of acetic acid will prevent fogging of the plate, to a great extent ; but, in the height of summer, these plates will not keep above twelve or fourteen hours. The next operation is

Fixing.

Either a weak solution of cyanide of potassium, or hypo-sulphite of soda, may be used ; it is quite immaterial which, taking care to wash the residue well out of the film before drying it.

This process is not so good as the Tannin, previously described, but is rather more sensitive.

CHAPTER VIII.

Negatives by Wet Collodion.

It is not my intention to describe minutely the manipulation, &c., of this process, but simply to give such hints as are likely to be of assistance to the tourist if he decides on working with Wet Collodion.

There is no doubt that however carefully plates may be prepared with different preservative solutions, there is a slight risk attending their use; the best judgment is sometimes deceived in estimating the actinic power of light; therefore plates receive over or under exposure, and the fault is not discovered until the operator may be miles from the spot whence they were taken. As a precaution against this error, some photographers carry a small hood or box in which they develope a picture, previous to leaving the "ruin or moss-grown tower" that has afforded them a subject. There is no doubt but this makes a greater certainty of hitting the right time, but is nearly approaching the paraphernalia appertaining to the wet process.

Wet Collodion, with ordinary care, *is* infallible; not but that sometimes the bath is foggy, the collodion streaky, or the developer muddy; these are evils arising from causes pretty well understood, and therefore under control. No one should think of out-door photography before he is a complete master of it at home; neither should he attempt to leave his home until the collodion, bath, developer, tent, camera, slides, nuts, screws, &c., have all been examined and proved to be in working order. The camera and lens have already been commented on; in addition to them the following articles will have to be taken:—

An Operating Tent.—I have no faith whatever in so-called developing boxes, or any contrivance where the results are left to chance; many ingenious inventions have been made for developing, &c. in a box, the arms of the operator being inserted through a sleeve, and the progress of the picture watched through a piece of yellow glass; except in the hands of a very clever operator, they are totally useless, and even then it is more by accident than skill that the picture is fully developed, without being carried too far, or stopped before the detail is brought out; this operation—the most delicate in the whole range of photography—requires a sharp eye and quick hand to manipulate with certainty, therefore a commodious tent is absolutely essential. There has been almost an endless variety of designs made, some good, some indifferent, many

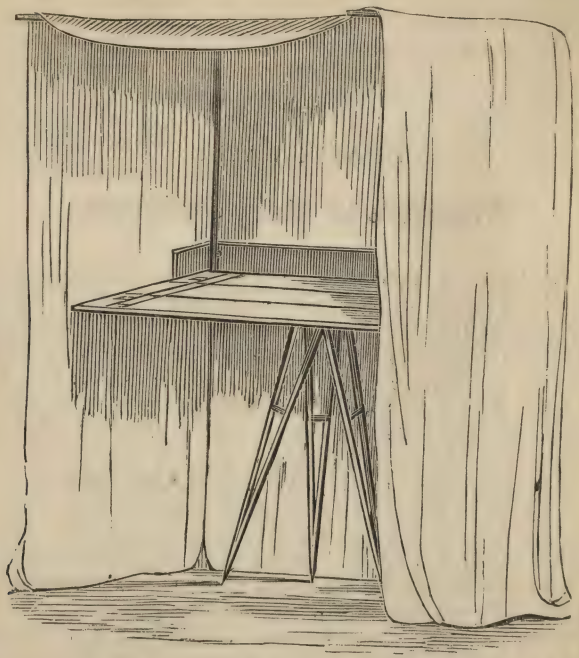


Fig. 19.

useless : for large plates, say 10 × 8 or upwards. A form represented by *Fig.* 19, is as good as any ; a table, thirty-four inches long and seventeen inches wide, is supported on a light tripod stand ; from each end an iron rod rises to the height of nearly three feet, carrying the cover overhead ; the table is composed of three pieces of pine, jointed together, and when in use kept rigid by means of cross-bars. The object in making it in this way is to increase the portability, it forming the packing-case into which the cover, &c. travel. When closed, as *Fig.* 20, it measures thirty-four inches long, five inches square, and weighs seventeen pounds.

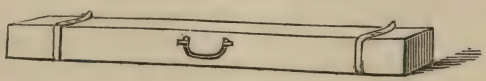


Fig. 20.

A second description is shown by *Fig.* 21 ; it is generally known as a Leake's tent, and is simply a wooden tray, about twenty-seven inches

long by sixteen inches wide; the lid being fastened to the tray by a twill covering, and when in use supported by uprights at the end. This also requires fixing on a stand; the cover does not come down to the ground, but fastens round the waist by means of a string.

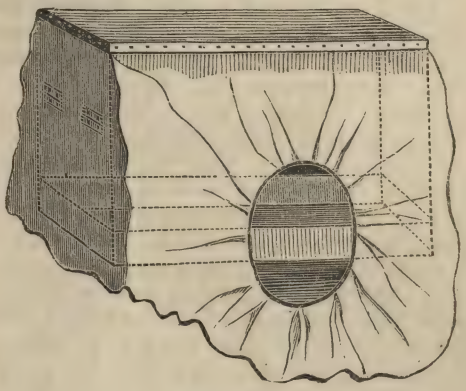


Fig. 21.

The same tray can be fastened on a carriage with legs, handles, and a wheel, thereby rendering the photographer independent of help; this constitutes Sutton's wheelbarrow tent.

A bath with a tight top is best; it may either be made of gutta-percha or glass, enclosed in a wood case; they are not so thoroughly water-tight as to travel safely when laid flat, nevertheless are the best contrivance yet known for a day out; when going a long journey, carry the bath solution in a bottle.

Have your collodion, developer, and fixing solution packed in bottles with corks, unless you do not object to tie the stoppers down every time you move your station; these cannot be better stowed away than in a field box, with separate divisions for each bottle and a rack to hold the glass plates. Besides the principal chemicals before mentioned, the following are required: — small bottles, containing glacial acetic acid, and solution of nitrate of silver, twenty grains to the ounce, filtering or blotting paper, cloths, leather, &c.

The collodion should be iodized some time, certainly two or three weeks, before it is to be used, then allowed to settle, and the clear portion poured off into the working bottle, but not filtered, which is a useless operation as well as wasteful; large makers never attempt to pass it through a filter, but always let it subside gradually.

There is no advantage in having the bath stronger than thirty grains to the ounce: keep it as near neutral as it will work, but if

anything rather inclined to show acidity with glacial acetic acid. Fused nitrate of silver has been recommended for this purpose, and undoubtedly is preferable to the commercial nitrate of silver, which is strongly charged with nitric acid, the price it is supplied at not paying the manufacturer for recrystallization. By fusing it, the acid certainly is got rid of; but I am inclined to think the reason baths made with this article give greater density and at first more satisfaction than others is that a portion of organic matter is fused in with the mother liquor, &c. from crystallization, and therefore after a time yields feeble foggy pictures. The safest plan is recrystallization; there is no perceptible trace or smell of nitric acid then left: should there be a difficulty in obtaining a sample that can be relied on, procure the ordinary commercial article, and make a saturated solution in hot distilled water; let this boil off for a short time, and then gradually cool; the crystals form round the bottom and sides of the dish, and can be readily fished out with a glass spatula, and put into a small funnel to drain. The remaining liquor may be further boiled down and again cooled, when a second crop of crystals is obtained. These are not so clean and pure as the first, but may be safely used: the remainder of the liquor had better be evaporated dry, and the residue used for printing purposes. The above is a troublesome and unpleasant job for the amateur, and will not succeed when very small quantities are operated on; certainly not less than five ounces of commercial nitrate should be taken at one time.

A porcelain evaporating dish, supported on a retort stand, and heated by a spirit-lamp or gas flame, is the most convenient arrangement.

The developer for landscape photography should either be pyrogallic and acetic acid, or iron.

No. 1.

Pyrogallic acid	6 grains.
Distilled water	4 ounces.
Glacial acetic acid	1 drachm.

No. 2.

Proto-sulphate of iron	40 grains.
Acetate of soda	20 grains.
Glacial acetic acid	1½ drachm.
Distilled water	4 ounces.

The formula No. 1 is that commonly in use, and may be considered a standard to work by: in cold weather it may be necessary to increase the proportion of pyrogallic and reduce the acetic acid; use distilled water, and filtering can be dispensed with.

The iron developer, No. 2, is capable of developing a negative without further aid; but many operators only use it to bring out the

detail of the picture, then fully wash off and intensify with No. 1 and silver solution. When developing with iron, under some circumstances there are unmistakeable signs of fogging before the density is obtained ; if so, change the developer and finish with pyrogallic and silver. Alcohol in most cases is unnecessary, and often injurious ; if the solution will flow freely over the film, discard it altogether.

Fix the picture, if possible, with hypo-sulphite of soda : there is no doubt that cyanide lowers the quality of a negative sufficient to destroy its brilliancy ; this is much to be regretted, as it is more convenient for the tourist, hypo. clinging to the hands and cloths so tenaciously that it is difficult to avoid marking the next picture ; and in most cases water is too scarce to be wasted in washing. For this reason some have recommended to postpone the fixing operation until the return home, simply flushing off the developer and putting the plates in a plate box, with gutta-percha grooves. There are two objections to this course ; first, you cannot judge so well the quality of your negative whilst the iodide is in it ; and, secondly, the film might easily be torn or separated from the glass in finishing : this is worth consideration ! There appears to be no help for the difficulties that may arise, except to go prepared with everything, and water cannot properly be dispensed with ; if anything is to be left to chance, throw up the inconvenience of wet collodion, and stick to the dry processes.

I always carry the water in a flexible mackintosh bottle, with a length of elastic tube, at the end of which is fixed a valve similar to that on a shot belt ; this bottle is suspended from the top of the tent, and the water can readily be directed over the picture as required.

A few words respecting the water met with during a tour may prevent disappointment. The bath, of course, will be made before leaving home, and sufficient solution taken as an extra supply to replace the loss by evaporation, waste, &c. ; but should an untoward accident happen, I would as a general rule undoubtedly prefer spring water to rain or river water. I have not had much difficulty in using common river, or filtered rain-water for the developing solutions, but should endeavour, if the means were at command, to use distilled in preference to any other.

CHAPTER IX.

Instantaneous Photography.

THE introduction of natural clouds into photographs, instead of the white paper skies that have for so long been tolerated, has compelled those photographers who aim at producing the best results to give a large share of their attention to instantaneous photography; and as many erroneous impressions are entertained by those only imperfectly acquainted with the method pursued by the best operators, it will be well for the aspiring amateur to divest his mind of them, previous to commencing his experiments.

I am frequently asked what is added to the collodion or bath, in order to render it quicker; but seldom do I hear a word mentioned about the developer, and it is there that the only chance is given whereby the exposure is lessened. There is no secret in the matter at all, beyond using the ordinary apparatus and chemicals in their most perfect condition.

Instantaneous stereograms are most readily produced, and an apparatus, as shown by *Fig.* 22, is very suitable; it consists of an ordinary

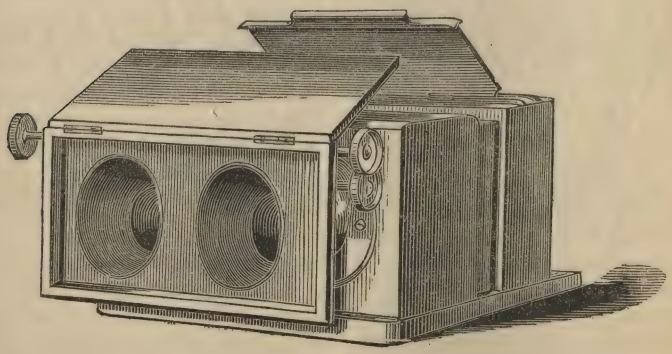


Fig. 22.

stereoscopic camera, fitted with a pair of portrait lenses: these lenses are to have a stop placed between the front and back combinations, with an aperture of a quarter of an inch, which should render all points from about forty feet distance to the horizon in correct focus. A

smaller diaphragm than this will be unnecessary ; but if the principal objects in the subject are situated in nearly one plane (that is, at the same distance from the lens as in a group of figures, &c.), an aperture of three-eighths or half an inch may be judiciously used, thus allowing the use of a larger proportion of restraining acid in the developer, or of reducing the exposure.

The exposure is managed thus : a frame is fitted on the hood of the lenses, to which a door or flap is hinged at the top ; the pin of the joint is extended and projects at the end, where it terminates in a brass milled head, by turning which the shutter or flap is made to fall and cover the orifice left in the frame corresponding with the lenses. Another very efficient plan is to have an extra frame made to slide over the outside body of the camera and project in front beyond the lenses, thus forming a sky shade ; from this hangs a thick velvet cloth, covering the front of the lenses, and dispensing with the usual caps ; by raising the cloth and then dropping it, the operator has it in his power to give the necessary exposure, and if desirable a trifle longer time can be allowed to the foreground than to the distance and sky.

Many ingenious contrivances have been designed for the same purpose, such as a sliding shutter in front of the lens with an aperture in the centre ; this is rapidly drawn down by springs, and the exposure is effected by the orifice passing the lenses in its transit. It is rather an awkward piece of apparatus, and is liable to shake the camera : true, that is not a matter of much importance ; still, as so-called instantaneous pictures really are not produced without some fraction of time, the greater rigidity there is in the apparatus the better.

Another plan is to have a sliding plate worked with a trigger, passing the stop between the lenses ; this is a very neat arrangement, and inconceivably short exposures can be given in this manner.

It is scarcely necessary to state that the chemicals must be in their best working condition, and no empirical substances, such as glycyrrhizine, gallic acid, or iodide of iron, &c. added to the collodion or bath.

The collodion most suitable contains a fair proportion of pyroxyline, the iodizer being modified according to the nature of the subject.

If the view is strongly lighted, with deep shadows and dark masses of foreground, a bromo-iodizer is best ; on the other hand, a simple iodized collodion gives better contrast to a subject which is more evenly illuminated, iodized collodion being more sensitive, but not allowing the dark portions of a subject to be brought out without overdoing those more strongly lighted. To apply these remarks to practice, use a bromo-iodized collodion for street scenes, interiors of abbeys, landscapes with dark foreground and distant sky ; but a simple iodized collodion for those purposes where extreme rapidity is essential, such as moving water, waves of the sea, &c.

The preparation of the plain collodion will be thus : one hundred grains of pyroxyline, free from acid, is put into a pint stoppered bottle,

with four ounces of absolute alcohol, and shaken well up ; to this add eight ounces of absolute sulphuric ether : it is advisable not to introduce the whole of the ether at one time, but to put about half the quantity first into the bottle, and the remainder afterwards.

Iodizing Solution.

Iodide of potassium.....	50 grains.
Absolute alcohol	4 ounces.

Iodide of potassium will not readily dissolve in alcohol ; therefore previously pound it in a small mortar, and moisten it with one or two drops of water, after which add the alcohol.

Bromo-Iodizing Solution.

Bromide of ammonium	10 grains.
Iodide of ammonium	18 grains.
Iodide of cadmium	50 grains.
Absolute alcohol	4 ounces.

Three drachms of plain collodion are mixed wlth one drachm of either of these solutions.

Prepare the bath with pure re-crystallized nitrate of silver, forty grains to the ounce, and saturated with iodide in the usual way ; when it has been made about twelve hours, try two or three pictures, and if it works foggy add a drop or two of extra glacial acetic acid to the developer ; but if that will not remedy the fault, as a last resource add a drop to the bath.

The developers in common use are pyrogallic acid and sulphate of iron. The pyrogallic acid is best for collodion prepared with iodide of potassium, and the iron developer for a bromo-iodized collodion ; when this is used, however, it is essential to intensify with pyrogallic acid; for the reduction with a minimum exposure is not sufficient, when employing iron alone. Make therefore a solution of iron, as formula, No. 2, page 40, and a strong solution of pyrogallic, say three grains to the ounce of water, and a grain of citric acid—not more.

When the apparatus and chemicals are all ready, proved and found right, and not before, a trial may be made on a suitable subject ; a good searching light is indispensable, and then there is little fear.

The manipulation requires considerable care to avoid stains and fog, when working with a neutral bath ; an experienced operator, however, soon knows the reason of this. In developing, as soon as the whole detail is fully out, throw off the iron solution, wash the plate well, and in a clean measure take half an ounce of the pyrogallic solution, and three or four drops of silver solution, twenty grains to the ounce ; continue the development with this until the required depth is obtained.

Fix the negative with hypo-sulphite of soda, and thoroughly wash at the time.

In conclusion, it must be remarked that some few pictures that have been exhibited are really instantaneous, that is taken in a fraction of a second; but the majority of those known as such have had exposures of a longer duration; and with the optical means at present within reach it can only be a compromise between two or more conditions; if the definition can be sacrificed by using a larger stop, almost any degree of rapidity may be had; or with a short exposure and a small stop the general outline of the view can be obtained, but the detail of the darker parts will not be brought out.

CHAPTER X.

Calotype Process.

This process recommends itself to the amateur on the ground of simplicity, portability, and certainty of a satisfactory result. It was originally known as the infallible process, and would be the one in general use, were there not such a strong cry for extreme sharpness, it being unable to cope with glass negatives, owing to the nature of the material on which the picture is formed; but, for pictures 12 × 10 or upwards, it is worthy of more attention than it at present receives.

The *rationale* of it is simply this: the paper placed to receive the image formed by the Camera is rendered sensitive to the action of light by various chemical preparations, which will be described as we proceed with the details of the process, so that where the light falls upon it, it is blackened; and where there is a shadow, no action takes place, consequently the paper is left white: this, you will observe, produces a picture which is just the reverse of nature, and is termed a negative; from this, by superposition on another prepared paper, an unlimited number of positives (*i.e.* pictures with the lights and shadows as in nature) may be produced.

The apparatus I should recommend to an operator in Paper Negatives would be a plain folding Camera, with one, two, or three double backs, each of which holds two papers—a single Achromatic Lens, with rack adjustment; this, fitted into a sling-case, and carried round the neck. The Camera ought also to be put into a leather case, which also holds the extra backs. A tripod Camera stand, similar to *Fig.* 7, will be all required for the field. The apparatus required for preparing the

paper is a flat board, rather smaller than the papers that are used; a quantity of clean, white blotting-paper, a bent glass rod, two gutta-percha trays, measures, &c.

The paper can be procured from most dealers in photographic chemicals ready iodized; but as that is not a difficult operation, the following description will include the whole process:—

To Iodize the Paper.

The selection of paper is a very important point. Hollingsworth's paper is suitable, if it can be procured from a good sample; the older it is the better, and the sheets carefully examined, rejecting all that have spots or unevenness of texture; then prepare the iodizing solution.

Dissolve in one ounce of distilled water sixty grains of nitrate of silver; in a separate measure dissolve, in one ounce of distilled water, sixty grains of iodide of potassium; then mix the two solutions, and a white precipitate will be produced; allow this to settle for some minutes.

When the precipitate, which is iodide of silver, has settled, pour off the water, and add a fresh supply. This removes the soluble particles, then wash two or three times with warm water, and add to this washed precipitate about six hundred grains of iodide of potassium, which will dissolve it; the addition of more water will render it turbid; but, on stirring it, it will become clear; do this till it no longer clears itself, then add a crystal or two of iodide of potassium, taking care not to use more than is absolutely required; in fact, it is safer to leave a little of the precipitate undissolved, as it is easily got rid of by filtration, and any free iodide of potassium interferes with the subsequent result.

There are several methods of spreading the solutions over the paper; for this, brushing is the most convenient, and is easily done as follows:—Place the paper on a board covered with blotting-paper; then, with a full brush, pass over it lengthways, then across, leaving no spot untouched, and hang it up to dry; when dry, it must first be floated face down on water for a few minutes, then immersed, taking care to remove all air-bubbles with a brush, or glass rod; leave it about fifteen minutes, then remove it into fresh water; again taking away all bubbles that may be formed on either side, for, if allowed to remain, they would cause white spots on the negative. Let the paper remain in this water twelve hours; then dry it.

The water dissolves out the iodide of potassium, leaving the iodide of silver precipitated in the pores of the paper, which assumes a primrose colour; this is called the iodized paper, and, if it has been thoroughly washed, it is insensible to light, and even improved by exposure to bright sunshine.

In the subsequent processes of exciting and developing, it is all-important that white light should be excluded from the operating-room; and for this purpose a piece of macintosh cloth, and one of yellow calico, are very useful when from home, for, with their aid, together with a few drawing-pins, almost any room may, in a few minutes, be converted into a temporary dark chamber.

To Sensitize Iodized Paper.

Cut a sheet of iodized paper to the size required, and make a pencil-mark on the side that has been prepared, and which is readily known by its colour, in the open daylight, but is difficult to distinguish in the operating-room; then prepare the solutions.

To excite the iodized paper, *i.e.* to render it sensitive to light, a solution of gallo-nitrate of silver is used; and as the same solution, though of a different strength, is used for development, it will be better to describe their proportions at once, as one depends on the other.

It is convenient to have four one-ounce bottles for these solutions, called Nos. 1, 2, 3, and 4.

No. 1. *Aceto-Nitrate of Silver.*

Nitrate of silver	50 grains.
Glacial acetic acid	2 drachms.
Distilled water.....	1 ounce.

No. 2. *Gallic Acid Solution.*

Alcohol	2 drachms.
Distilled water	6 drachms.

Saturated with gallic acid.

These two, in certain proportions, would do to excite with, but the paper would very soon become discoloured; this is avoided by using them more dilute, as under:—

No. 3.

One drachm, No. 1.
One ounce water.

This is called the dilute aceto-nitrate of silver.

No. 4.

Ten minims of No. 2.
One ounce distilled water.

This is called dilute gallic acid.

For exciting, equal parts of No. 3 and No. 4 are used; and for developing, one part of No. 1 to five parts of No. 2.

Different photographers use various methods of spreading the exciting solution, and each, of course, praises that with which he has been most successful; some use a brush, others a glass plate, or Buckle's brush, which is a tuft of cotton wool fastened in a glass tube; a bent glass rod is preferred by others, and, for a moderate-sized sheet, is preferable.

Having everything at hand upon the table, the paper may be sensitized in the following manner:—Pin the sheet of iodized paper on a board of the same size, or a trifle smaller, with the marked side upwards, placing a sheet or two of clean, dry blotting-paper underneath.

In a *clean measure*, mix equal parts of solution No. 3 and No. 4; for a sheet 9 × 7, thirty drops of each will be sufficient; then lay the glass rod across the paper, and pour quickly along the rod so much of the solution as will thoroughly wet it; spread the fluid quickly, by moving the rod along to the opposite end of the paper, applying more solution, if required; when the whole surface of the paper is evenly wetted, allow it to remain about a minute; then, with a clean piece of blotting-paper remove the excess, *i.e.* leaving no shining patches; take the paper from the board, and place it between blotting-paper while you excite other sheets, prepare the frames, &c.; and, to prevent accidents from light, it is better to put it into a box or drawer.

These papers can be used whilst moist, and are more sensitive in this state: but, if meant to be kept a day or two, they should be *thoroughly dried*, by being exposed to a gentle heat, before placed in the dark slide.

Exposure in the Camera.

Having very carefully cleaned the glasses of the Camera frame, place the paper in it.

The exposure in the Camera is so entirely dependent on circumstances, that it is impossible to give any fixed *rule;* with a lens of fourteen-inches focus, half-inch stop, and moderate sunshine, five to seven minutes, according to the subject, is in general sufficient.

Development.

Upon returning to the operating-room, it is advisable to develope the pictures with as little delay as possible; therefore, having the solutions of aceto-nitrate of silver and gallic acid (Nos. 1 and 2), at hand, remove the sheet of paper from the dark slide, and lay it face upwards on a sheet of clean blotting-paper; and, in a clean measure, mix one part of solution No. 1, and five parts of No. 2; spread this over the paper, as directed for sensitizing, but do it as quickly and evenly as possible, not using more solution than can be helped, it being desirable to keep the paper moist, and not more.

The picture will be gradually developed; at first you will perceive an intensely black sky and white trees and buildings; as the develop-

ment progresses, the negative will go on improving, until in about a quarter of an hour it will begin to blacken all over, and appear to be fading away ; this, however, is not the case, for, by holding it up to the light, it will be found to have acquired great intensity ; and if the exposure has been correctly timed, the half shadows will begin to appear in the foliage and dark shadows, whilst the general appearance of the picture will be strong and vigorous. If the chemicals employed have been pure, and these details carefully attended to, there is nothing to fear in carrying the development to a great degree of intensity ; it is a common and a great fault to arrest it before complete, and it must be borne in mind that a good negative is almost lost on the surface while on the developing board.

When a picture has been over-exposed in the Camera, it can be seen on removal from the frame ; and, when this is the case, it may often be rescued by beginning the development with gallic acid alone, and then using the mixture with aceto-nitrate. For this, however, no exact rule can be given ; the operator soon learns how to humour a picture under different adverse circumstances.

It not unfrequently happens that there are very strong shadows with fine and interesting detail ; but, if we give sufficient time to bring out the dark parts of the picture, the sky and light parts will be heavy, and devoid of beauty and interest. In a case of this kind, endeavour to take care of the shadows ; and, if the sky is over-done, a little lampblack will make it opaque, whereas nothing will restore half-tones and detail which may have been sacrificed to obtain a black sky.

It is always desirable to have the exposure long enough, or the half-tones will be wanting, and the result will be what some one has not inaptly termed a specimen of the "soot and whitewash style."

An over-exposed negative has a dull, red appearance, and is destitute of vigour and sharpness ; but, when sufficient time has not been given, the high lights are hard and black, with neither middle tints nor detail in the shadows.

The development having been carried as far as is thought expedient, the picture must be removed from the board, placed in a dish, and washed with water, to remove any excess of gallo-nitrate of silver from the surface, and then left in clean water for some time ; it may, in this state, be dried and fixed when opportunity offers, as it is now almost insensible to light.

Fixing and Waxing the Negative.

The removal of the iodide of silver from the paper is best effected by the aid of hypo-sulphite of soda.

Hypo-sulphite of soda	1 ounce.
Soft water	6 ounces.

Immerse the papers in this solution until the yellow iodide is dis-

solved, which can readily be determined by inspection of the high lights ; about five minutes will accomplish this ; then thoroughly wash in several changes of water, to remove the fixing solution, and finally dip them for a minute or two into hot water ; this insures the permanency of the negative, besides removing the size, and thereby facilitating the waxing of the paper.

The object in waxing the paper is to render it more transparent, and so reduce the time of exposure in the printing frame ; otherwise that would become a tedious process. It is quickly and easily accomplished, by laying the negative, when perfectly dry, upon a sheet of blotting-paper, and scraping a small portion of white wax very fine ; strew it over the surface, then cover with another sheet of blotting-paper, and pass over them a warm iron ; then remove it to fresh blotting-paper, and again pass the iron over them ; by so doing the surplus wax is absorbed.

The negative is now finished, and may be employed for printing from in the usual and ordinary manner.

Failures

mostly arise from imperfect cleansing of the measures and rods used in sensitizing and development. Operators who have been accustomed to the Collodion process are not sufficiently careful in this respect.

Badly iodized paper is another frequent cause of complaint ; amateurs will do well to purchase this ready to use. If the chemicals are good, the solutions fresh and bright, the papers exposed within two days after they were prepared, and common ordinary care employed, failures are unknown ; and it is impossible to have any photographic process more certain in its results than this.

CHAPTER XI.

Waxed Paper Process.

The Calotype process, as previously described, is the simplest, and undoubtedly the best, when opportunity offers to expose the papers within a day or so of their preparation ; but, when it is desirable to keep them several days, or a week or two, the Waxed Paper process

offers the facilities for doing so. It, moreover, is the only certain and efficient paper process for hot climates.

The method of preparing the paper with wax, and also of iodizing it, which are the preliminary operations, are rather difficult and tedious to perform, but the paper can be procured ready for exciting in the silver bath, thereby avoiding much inconvenience.

To Wax the Paper.

Obtain the purest white wax, without admixture of stearine or spermaceti (common white wax of the shops will not do). Melt this in a shallow dish, and soak the sheets of paper until completely saturated. As it rapidly cools, the pan containing the melted wax should be fixed over a vessel containing hot water; by this means a more even temperature is obtained. A common hot-water dish or plate answers extremely well. When the papers are well soaked, hang them up before a fire so long as any wax continues to drop; afterwards place them between two pieces of plain paper, and enclose the whole in several folds of blotting-paper. Pass a warm iron over this two or three times, when they will be ready for iodizing; be careful the iron is not too hot, or it will spoil the wax and stain the paper. A sheet well prepared ought not to have any shining points on its surface when viewed by the light, and should be equally transparent.

To Iodize the Paper.

Mix in a dry state:—

Iodide of potassium	8 drachms.
Bromide of potassium	1 drachm.
Iodine	5 grains.

Now dissolve in a separate measure

Sugar of milk	8 drachms.
Distilled water	1 pint.

Add the former mixture to this, and filter through a piece of muslin. Instead of the distilled water, many operators use rice-water, which is made by boiling gently an ounce of rice in a pint of water for half a minute, and, while warm, filter through a piece of fine muslin, and strain it when cold.

To prepare the paper, pour this solution into a glass or new porcelain pan, and immerse the sheets one at a time, until you have five or six soaking, taking care to prevent any air-bubbles from remaining underneath. The greasy nature of the waxed paper impedes the entry of the fluid; it therefore is necessary to leave them soaking for a considerable time, say four or five hours. In the meantime the dish may be covered with a sheet of plate-glass. When removed from this solu-

tion, it is desirable to rinse them in another pan of clean distilled water, removing them singly, and then hung up on a line by means of bent silver or coated pins, until dry: at the bottom corner of the sheet attach a small piece of bibulous paper, which will more readily absorb the moisture, and cause the paper to dry quicker and more evenly. The sheets, when dry, should be placed in a portfolio, until required for use, care being taken not to touch the surface with the fingers, or to expose it to any heat, else the wax will be disturbed.

The paper now is of a purple tinge, and will retain its properties for a considerable time without injury, and is quite insensitive to light. The iodizing liquid that remains after this operation may be kept for future use, simply filtering it before it is used.

The papers being cut to the size required for use in the Camera, the next operation is

To Sensitize,

which is done by immersing the paper in a solution of acetic nitrate of silver, prepared by

Nitrate of silver	40 grains.
Distilled water	1 ounce.
Glacial acetic acid	1½ drachm.

As this paper will keep several days, or even three or four weeks, if excluded from the light, the readiest way will be to prepare a number at once, and for this purpose they should be immersed separately in the solution until you have five or six soaking; let them remain there about ten minutes, or until the purple tint which the paper acquired in the process of iodizing is removed; when this is the case, remove them singly, and plunge them into a porcelain pan, containing distilled water. Let them remain here three or four minutes; then remove them into another pan of water. By this means they may be preserved sensitive some considerable time before used, remembering that the oftener they are washed the longer they will keep, but the less sensitive will they be. After the final washing, lay them between sheets of clean white bibulous paper, to absorb the principal moisture, and then hung on a line to dry: the paper, being now sensitive to light, must be preserved in a blotting-book or portfolio, until required for use.

The exposure in the Camera is regulated by the number of washings the paper may have had when sensitized, and will vary, with the light and the nature of the object, from five minutes to a quarter of an hour. With a lens of fifteen or sixteen-inches focus, using a stop of about three-quarter-inch diameter, in a moderate good light, the sun not shining on the object, about a quarter of an hour will be required—that is, supposing the object is moderately well lighted; but if it is a scene containing a group of very dark trees or foliage, longer time must be

given. Should the sun be shining, half the exposure will be sufficient. However, after the paper has been exposed in the camera — the dark slide of which for this purpose is made with two plate glasses, to enclose the paper and keep it flat—it is ready for the next operation, which is

Developing the Picture.

This portion of the process may also be delayed several days, if desired (of course, in the meantime, the waxed paper has to be carefully preserved from exposure to the light); or it may be proceeded with at once.

The agent for developing the picture is a saturated solution of gallic acid.

Gallic acid	3 drachms.
Distilled water	12 ounces.

Mix these in a stoppered bottle, and stand it in a warm room for a few hours, occasionally shaking the bottle. When required for use, filter sufficient into a shallow pan or dish, to the depth of about a quarter of an inch, and add a drop or two of glacial acetic acid, and the same quantity of alcohol: then plunge the paper into this solution, where it is to remain undisturbed for a few minutes. As soon as traces of the picture are seen, add a few drops of the acetic nitrate of silver, such as was employed to render the paper sensitive; it then rapidly begins to develope. When it is sufficiently intense, it must be washed in a fresh pan of water. The time required for development will vary considerably, depending upon the amount of exposure the paper may have had. An under-exposed picture can be sometimes saved by allowing a longer time to develope; but this extremity should not be resorted to unless it is compulsory; it should (if all the previous proceedings have been properly timed) be fully brought out in about half an hour: still I have had instances where three or four hours have been requisite; but, in these cases, the developing solution must be frequently changed, or it will discolour the picture.

The next operation will be

Fixing the Negative.

All that is required for this is to remove iodide of silver, and must be done immediately after developing. Having first washed the picture in clean water, immerse it in the hypo-sulphite bath.

Hypo-sulphite of soda	6 ounces.
Soft water	1 pint.

It will require to remain in this from ten to twelve minutes, to com-

pletely remove the iodide of silver ; if allowed to remain a longer time, the darker parts will suffer. The negative must be well washed to remove the soda, and then left for an hour or more in a large vessel of running water to soak ; when dry, lay it between two sheets of bibulous paper and pass a warm iron over it, to restore the wax to its original transparency, which has been impaired by repeated washing, &c.

CHAPTER XII.

Printing Process on Paper.

THE term "printing" means the formation of positive copies from the negative previously obtained. In order to render this more intelligible, it will be advisable to describe the difference between negatives and positives.

A negative picture is one that has the lights and shades reversed; that is to say, if you hold it up to the light, and look through it at the sky, you will find that those objects which were white in the landscape are perfectly black or opaque in the picture, while black or dark subjects are transparent: it should be remembered that the pictures taken in the Camera on glass or paper, by any process, are all negatives, consequently useless until the positive has been obtained from them.

Positives may be printed on paper or glass; if they are intended for stereoscopic pictures, better results will be obtained by printing on the glass, producing what are generally termed "transparent pictures." This method is also applicable for taking magic-lantern sliders. Positives are also printed on paper, either from glass or paper negatives. There are several varieties of paper and methods of preparing them, which may be reduced into two divisions, viz. Albumenized paper prints and Plain paper prints. The advantages of albumenizing the paper is, that the picture is kept on the surface, and therefore is sharper. For portraiture, or small and delicate pictures, it therefore is indispensable, but, for large prints, the glaze is, by many artistic eyes, considered offensive, and they are content to sacrifice extreme sharpness for general effect.

Printing on Albumenized Paper.

The apparatus necessary for this purpose consists of a shallow glass pan, two or three porcelain pans, a glass rod, pressure frame, and albumenized paper. As the preparation of albumenized paper is a matter of some difficulty, and is seldom produced by the amateur so perfect as by those who devote their time to its manufacture, I should recommend that it be purchased ready for use, rather than incur the risk of failure in future operations.

Previous to commencing, cut the papers into the size required, leaving a margin of about half an inch over the size of the negative, and mark with a pencil in one corner the prepared surface, so as readily to distinguish it in the dull light of the operating-room: the proper side will be readily known by its having a high gloss on the surface; it then should be examined, and only those sheets retained that have an even coating, free from spots or smears; the paper, in this state, is unaltered by light, and may be kept any length of time, if preserved from damp.

The first operation will be to

Sensitize.

The paper, a short time before required for use, is to be rendered sensitive, by floating on a solution of

Crystallized nitrate of silver	60 grains.
Distilled water.....	1 ounce.

Let this thoroughly dissolve, and filter it into a glass pan, so as to have a depth of about half an inch; then, in the dark room, take the paper, and holding it by the two ends, using both hands, let it slightly belly or fall in the centre, which must be carefully lowered, so as to touch the surface of the silver, then gently lower the two ends, until the whole is floating; by this means the air-bubbles, which may form underneath, are expelled. The paper will require to remain on the solution about three minutes, or from that to four or five minutes, to thoroughly saturate the coating of albumen, when the corner is to be gently lifted with a pair of wood or horn forceps, and the sheet hung up in the dark, to dry; should a pair of forceps not be at hand, a piece of clean wood may be used for the purpose, and, after it has been raised, a corner of the paper may be taken between the fingers, and pinned on to a line to dry: to facilitate the drying, attach a small portion of filtering or bibulous paper to the bottom corner of the sheet, which will rapidly absorb the moisture. All this, and the following preparation, should be done in a dark room, or by the light of a candle, as the paper now is sensitive to the action of white light.

The condition of the silver bath has a material influence in regulating the strength and vigour of the proof; it is essential that the

strength should be fully maintained to sixty grains of silver in each ounce of water (for the means of regulating this, see Appendix); and likewise, that it have a slight acid reaction, which is shown by the reddening of a piece of blue litmus paper; if that does not show its presence, add a few drops of dilute nitric acid, until the desired effect is produced.

The silver solution becomes discoloured in use from the action of the Albumen: to prevent any injurious effects from this cause, after having prepared a dozen papers, return the solution into the bottle, and add about a quarter of an ounce of kaolin, shake the whole well up, and after it has had time to subside, filter again for use into the glass pan. I recommend glass pans for the silver solution, as porcelain absorbs to a greater extent the chemicals that are used in them. When the paper is thoroughly dry, we may immediately or, if more convenient, delay for a day or two the next process, which is

Printing the Positive.

The negative is laid face upwards on the glass of the pressure frame, and over this the paper, albumen side downwards, bringing the whole into close contact with the pressure board; then close the cross bars or arms and remove into the daylight, turn the frame face upwards, and expose it in the full direct light of the sun: if this is not practicable, as is often the case in winter, let it stand in as bright a light as possible. The time of exposure will be, with a bright sunshine, from five to ten minutes, or, according to the light, up to three or four hours; but the correct time may readily be determined by examining the progress of the paper during the process. Remove the pressure frame into the operating-room, and unfasten one of the cross bars, then lift half of the back-board, which is jointed for the purpose, and the proof will be seen: this should be allowed to attain a colour several shades darker than it is intended to remain, as it loses its depth considerably in

Toning and Fixing.

When the print is removed from the pressure frame, if the exposure has been properly regulated, it will have a bold, vigorous appearance, but of an unpleasant, red tone, and which would be further increased in the subsequent process of fixing; therefore it is desirable to previously tone the picture by the aid of chloride of gold, which not only makes it a presentable work of art, but also increases its permanency. To do this, it is first necessary to wash it under a stream of running water for a few minutes, to remove the silver that remains in the paper; then prepare the

Toning Bath.

Carbonate of soda ..... 1 grain.
Distilled water ..... 8 ounces.

Add to this

Chloride of gold* ..... 1 grain.

A very convenient form in which chloride of gold can be kept, and small quantities measured out as desired, is, to dissolve four grains in an ounce of distilled water, *i. e.* take a usual fifteen-grain tube and mix its contents with three and three quarter ounces of water; each quarter ounce of solution therefore contains a grain of gold; in this state, it will retain its properties for a very considerable time uninjured.

The Toning bath must not be mixed in large quantities; it is advisable only to prepare sufficient for the day's use, and, when done with, the remainder thrown away; therefore, if only a few prints require toning, do not use so large a proportion of gold solution as the formula gives, for the exact proportion is not a matter of much importance: each grain of gold is calculated to tone about ten pictures, stereoscopic size; that will, therefore, afford a guide as to the quantity that is wanted in solution; for it makes but little difference, except in time, whether the grain of gold is diluted with six, ten, or twelve ounces of water. When the print has been taken from the pressure frame, and the silver completely removed by washing, which is known to be the case by the liquid flowing away clear, immerse it into the toning bath: this is most conveniently used in a shallow porcelain pan; and a number of prints can be toned at the same time in one vessel, if care is taken to keep them from settling together; the danger is that they will rise above the surface of the fluid, or lie together in close contact; either casualty would produce a red stain; it is therefore desirable to keep them constantly moving. When the supply of gold is in a large proportion, the desired tone will be attained in five to seven minutes; but, as it becomes older, its toning properties are more sluggish.

Some considerable amount of practice is needed to know at what stage to remove them from the bath. When they have been in it for the time previously indicated, they generally have changed in colour from red to blue, or purple; but, if immediately removed and fixed in hypo, they change to a warm brown, and, for many subjects, it is the

* Chloride of gold is largely adulterated for the purpose of sale. Purchasers should insist, therefore, in asking for pure chloride of gold, which can be procured from most respectable dealers in photographic chemicals; but, when offered at a price below that which allows a fair remuneration for the trouble of its preparation, great suspicion must be felt in using it. Carbonate of soda and chloride of sodium are the substances most commonly employed for this purpose; they do not have any deleterious effect in its use, but are simply used to increase the weight of the article; and the combination not being deliquescent, presents a more attractive appearance to the eye.

best to strive for: yet many persons prefer a darker colour, more approaching to a purple, which can readily be obtained by leaving them a few minutes longer toning.

The Fixing bath is made by dissolving an ounce of hypo-sulphite of soda in six ounces of soft water, and the prints are plunged into it direct from the toning bath; they may remain in this for ten minutes or a quarter of an hour, and afterwards placed in a pan and left to soak for some hours in running water.

PRINTING ON SALTED PAPER.

Landscapes or buildings generally have a more artistic appearance when printed on Salted Paper; the high gloss which is admissible in portraiture or stereoscopic pictures is a great drawback in the larger views; moreover, the black tone is easier obtained on this description of paper.

Hollingsworth's plain paper is most suitable, and the first operation of

SALTING

is performed by soaking the sheets in a solution of

Chloride of ammonium	100 grains.
Citrate of soda	100 grains.
Gelatine	10 grains.
Water	10 ounces.

The use of the gelatine is to prevent the picture from sinking into the paper, and should be dissolved in hot water, and the other chemicals afterwards added; the citrate of soda, in the salting solution, has considerable influence in modifying the ultimate colour of the print. It is prepared thus:—Fifty-six grains of pure citric acid are dissolved in a small quantity of water, and sixty-six grains of bicarbonate of soda are added, which, being the theoretical quantity, should neutralize it; but, as the citric acid is not always pure, it is advisable to use an excess of it, else the pictures will not be clean, owing to the excess of alkali.

The papers are to be floated on this solution for one minute, and then hung up to dry by the aid of wire hooks or spring clips. Photographic papers require to be examined before they are used, and only those sheets retained that have an even texture, free from spots, &c.; and as there is a difference in the two surfaces of the paper, it is advisable to place a pencil-mark on the rough side, to more readily distinguish it in the dark operating-room. The wrong or rough side may be readily known by the wire marks; but should there be any difficulty in determining it, just wet one corner, when it will be clearly seen. Paper, in this state, can be readily obtained, fit for the next operation, and at a

very reasonable price. The subsequent proceedings, such as sensitizing, toning, and fixing, are the same as directed for albumenized paper.

CHAPTER XIII.

Printing Transparencies on Glass.

TRANSPARENT POSITIVES.

TRANSPARENT Positives are produced from glass negatives in two ways. The first, by printing on a dry collodion plate in a pressure frame, in the same manner as prints are made on paper. The second plan is to copy on wet collodion plates by the aid of a copying Camera.

Printing on glass in the pressure frame is the most simple, and, for stereoscopic pictures, the usual method employed; but, for magic lantern sliders, experience has shown that the aid of the copying Camera is a great acquisition. Pictures produced in this manner have a greater clearness and freedom from fog than any others.

PRINTING TRANSPARENCIES, BY THE DRY COLLODION PROCESS, FOR STEREOSCOPIC PICTURES.

The negatives that have been produced by any of the processes heretofore described are available for the usual printing process, on paper as well as on glass; but the effect of a good transparent positive is so far superior to that on paper, that the additional trouble is not worthy of consideration.

Any dry collodion process will be available for this purpose, but preference should be given to the Fothergill or Tannin process. The latter has several peculiar advantages over the others, but whichever plan is adopted, the manipulating or preparing the plates is similar to that previously described. When about to be used, place them in contact with the negative, and press together in an ordinary pressure frame, so that the prepared surface of the plate is next the film of the negative. Behind the plate, have a strip of black velvet to absorb the light, as the

reflection from a bright surface would impair the sharpness of the copy; when all is ready, cover the whole with a dark cloth, and carry the frame into the open air, remove the cloth, and expose the frame to the action of the light.

The exposure required will be about six to eight seconds in the shade (as the glare of the sun would be far too powerful), or fifteen to twenty seconds in the diffused light of a room; and when the time of exposure has elapsed, return to the operating-room, where the plate is to be removed from the frame, and the picture developed in the same manner as described for negatives, see page 32, employing however two grains of citric acid instead of the glacial acetic; it is afterwards to be washed and fixed, when it is ready for mounting. If printed from a negative taken in a Binocular Camera, the glass must be cut in half and transposed before they are fixed in the frame; and they require a sheet of fine ground glass placed behind them, or else varnished at the back with a dull, drying varnish. Pictures produced by the Fothergill or Collodio-Albumen process may be improved in colour by being toned with a weak solution of chloride of gold; say one grain of gold to five or six ounces of water.

Should it be thought desirable, the operation of printing may be performed by gaslight, or with the light given by a moderateur lamp: in this instance, the time of exposure will have to be increased to about five or six minutes: the pressure frame should be held as close as possible to the light, so as to thoroughly illuminate the whole surface. In printing on glass, care must be taken not to rub the two surfaces against each other, but lay them gently but firmly down, and on this the board of the frame: it is indispensable that the interior of the board be covered with black cloth, or velvet.

The negatives to be used for printing transparencies ought not to be dense, but rather such as might be considered too feeble for ordinary printing; otherwise the shadows will lose their force by over action of light before the finer parts of the picture are sufficiently printed in. Negatives that have been developed with sulphate of iron are peculiarly suitable for the purpose, and with the tannin dry plate the best results are obtainable.

The development of these pictures is more simple and manageable than with those taken in the camera, owing to the strength of light in forming the image; and the richness of tone which the Continental artists produce is closely imitated by this process. The tannin imparts a strong brownish tone to the picture which citric acid corrects, and therefore is preferable to acetic. Use a bromo-iodized collodion that has been iodized some time, give a long exposure, and restrain the development; by this means warmth and softness are secured, and subsequent toning rendered unnecessary.

For Magic Lantern Slides.

Transparent positives printed on glass from a negative in the same manner as for stereoscopic sliders can be used in the magic lantern; but they are not so effective as they might be for two reasons: first, the depth or opacity of the shadows which are essential to a stereoscopic picture prevents the light of the lantern from penetrating as thoroughly as it should do, therefore the image thrown on the screen is hard; but a more fatal objection is that in all dry processes there is an almost imperceptible fog or veil over the film, which does not show in the stereoscope, but when magnified by the lantern is sufficient to produce a general indistinctness.

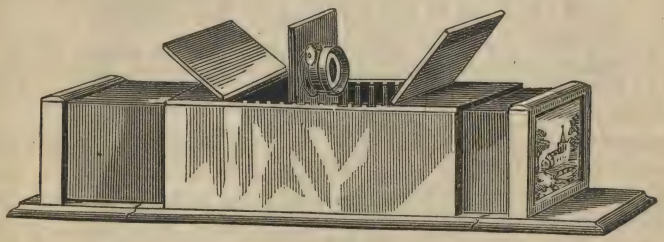


Fig. 23.

The copying camera, *Fig.* 23, is a great acquisition, producing pictures of far greater clearness and transparency than prints on dry collodion; it is arranged thus. The lens, either a portrait combination with a stop between the glasses, or an achromatic triplet, is placed in the middle compartment; and at one extremity of the camera, the negative to be copied is fixed in such a manner that no light can reach the lens except that which has passed through the negative; the other end carries the dark slide containing the prepared sensitive plate: the light is admitted through the negative by inclining the camera towards the sky, or by reflection from a common mirror.

The amateur in copying may find some difficulty in understanding the alterations in the focus of the lens; this point will be much simplified, if he recollects that the closer the object to be copied is brought to the lens, the further off will the ground glass have to be taken, and consequently the image will be of a larger size.

If the desire is to produce the positive copy on the same scale as the original negative, the distance from the negative to the lens must be the same as from the lens to the sensitive plate.

The readiest method is to fix the negative in its carrier, and focus by the sliding body at the other end of the camera; should the image on the ground glass be too small, place the negative, say half an inch

or more nearer to the lens, again focus by the sliding body, and, if required, make a further alteration in the relative distance between the previous named points.

In taking impressions by means of the copying camera, from transparent negatives, it is important that the negative should possess a full amount of detail, and not be very deep or intense ; in fact, the best results are obtained from a negative but little deeper than a direct positive ; therefore, an over-exposed negative that has been developed with citric acid is by far the best : one under-exposed would be too violent in its contrasts and unsuitable for copying. For the same reason, views from nature are not so effective as copies from good prints or engravings ; in fact, if they contain foliage they are harsh and useless ; architectural subjects are more satisfactory, the photograph rendering the fine work of the graver with a fidelity beyond the reach of manual dexterity on so reduced a scale.

Having arranged the Camera, and obtained the proper focus, proceed to the manipulation, which is precisely similar to the usual *positive* collodion process, employing either plain plate or opal glass ; if the intention is to take pictures suited for use in the magic lantern, employ plain plate, but if for the stereoscope, a very effective picture is produced by using opal glass.

The time of exposure will be longer than would be given with a lens of the same form, and using the same chemicals in ordinary photography, for the amount of light passing through the lens is considerably less than if the operator were working from the natural object.

When the collodion plate is removed from the dark slide, develope with

Proto-sulphate of iron	20 grains.
Glacial acetic acid	30 drops.
Water	1 ounce.

Be sure not to carry the development too far, but as soon as the detail is brought out in the shadows, which is known by holding the plate up and looking through at the light ; it must be stopped by washing with water, fixing with the usual cyanide of potassium.

Where the picture is intended for use in the stereoscope, it may be taken on opal glass ; this is white sheet glass, one surface of which has been coated, or flashed, with opal, and afterwards vitrified by heat ; these pictures present the remarkable appearance of being positives either by transmitted or reflected light—the results, where carefully done, are very beautiful and well worthy of attention.

The focussing and development are precisely the same as for transparent positives previously described, observing that the collodion is to be poured on the side of the glass that has been flashed with opal, and that the picture will require darkening after it has been fixed, for the deposit of silver is too bright to make a contrast when viewed by

reflected light; therefore, after the cyanide fixing solution has been well washed off the plate, the alabastrine solution must be poured rapidly over the surface whilst still wet, and the silver deposit is instantly deepened to a rich tone; the solution should then be immediately washed off, and the plate dried and varnished.

Magic lantern sliders are coloured with vegetable colours, ground on a slab of plate glass in mastic varnish diluted with spirits of turpentine; mineral colours are not sufficiently transparent: the materials can be obtained from my establishment, 22 Skinner Street, London.

The most useful are gamboge, Italian pink, Indian yellow, Prussian blue, madder brown, burnt sienna, crimson lake, madder lake, and lamp black. These are sold in small boxes at one shilling each colour, finely levigated, and suitable for the purpose. The brushes are made of sable and camel's hair; the former are best, being firm and elastic, yet soft to the touch, and cost from four shillings to eight shillings per dozen, according to size. The colours, as before stated, are ground in mastic varnish, which is somewhat a tedious operation; many, such as madder lake and Italian pink, crimson lake and sienna, are improved if worked with Canada balsam as well as varnish.

The *modus operandi* is this: sufficient of the dry powder colour is placed on a glass slab, and moistened with a small portion of mastic varnish or Canada balsam; they are intimately mixed with a palette knife, and thoroughly ground with a glass or stone muller, and afterwards thinned to the proper consistency for working with spirits of turpentine. The photograph is placed in a slanting position on a table, at a convenient height for working, and behind it is laid a piece of white paper to reflect the light. Then commence by etching with a fine-pointed knife those portions of the picture which are too deep and strong. Considerable care must be taken to do this in an effective manner.

The sky and distance is first laid in, using madder lake, Italian pink, and Prussian blue over the whole sky, making the tint lighter as the horizon is approached. Then put the dark clouds with a stronger blue and madder. The edges of the clouds require softening with a dabber, made by cutting the point off a large camel's hair brush. This is worked over the sky, to blend and soften it; but if overdone, the forms of the clouds will be destroyed; then gradually work down to the foreground, giving strength and force as the prominent objects are encountered. After the picture has been coloured all over, it requires "finishing;" that is, it will be necessary to subdue or enliven portions, to give life and effect. A few judicious touches of opaque black here and there will materially increase the intensity, and the etching-knife or needle-point are equally useful.

The principal difficulties that have to be overcome, are to prevent the colours from running one into the other, and in laying them flat. An important secret is to use as little varnish in grinding them as pos-

sible, and not to take too large a quantity in the brush at one time; neither be too sparing; for if, in going over a large surface, it is requisite to leave off and obtain a fresh supply of colour, it will be impossible to avoid showing the pause made by the brush.

I have noticed, in an earlier portion of this Chapter, that negative views from nature are not so effective as copies of engravings, and it is not likely the chemical difficulties which arise will ever be sufficiently under control to render them of much service; whilst a green tree produces a transparent spot in a negative, therefore an opaque one in the positive copy, and showing a black patch on the screen, which no colour will penetrate, there is little hope of the better class of hand-painted views being superseded. This is much to be regretted, as in a photograph we have a guarantee for truthfulness, which is generally a weak point with artists if it interferes with the means of producing a strong effect. Photographic copies of engravings, of course, have all the faults of the engraver in them, and therefore reluctantly we must, for the present, assign this portion of our "art science" to the hands of the amateur; it is valuable to him as being almost the only means by which pictures at all presentable in the lantern can be produced.

APPENDIX.

FOCUSSING THE VIEW.—So apparently simple as focussing a view, to ensure general sharpness, may seem, it is evident that many amateur photographers do not fix the lens in its best position. A little consideration will explain the difficulty they meet with.

It is a fundamental optical law, that objects situated at different distances from the lens must have a different focal point behind it. The farther they are off, the shorter will be their focus; and, as a necessary consequence of this, the foreground of the picture will naturally require the sensitive plate to be removed farther off.

If a small stop is used, and the focus adjusted for a given object, the rackwork may be shifted either in or out through the space of an eighth of an inch, without producing any increase or diminution in the sharpness of the image thrown on the ground glass of the camera; this is termed "depth of focus," and is caused by the small stop rendering the pencils fine and attenuated; but when a large aperture is employed, the slightest movement of the focussing rack is shown by its effect on the definition of the picture.

Therefore, as objects situated at different distances from the lens come to a focus in a different plane, it is evident that, with a large aperture, it will be impossible to get more than one of them sharp without altering the focus of the lens; but by focussing for the middle distance and reducing the aperture, the pencils are so very attenuated, that no *apparent* difference is shown between those situate in close vicinity to the camera and others at a distance of a quarter of a mile; but were the small stop inserted previously, and either the distant or the near objects only focussed, it is possible the position of the lens, finally adopted, might be such as only to give sharpness to either the one or the other that it had been adjusted for. When racked in, as far as possible (without sacrificing the distinctness of the most distant portions of the view), the foreground will undoubtedly be woolly and queer. For this reason, and because it is difficult to determine the best position of the lens when the light is feeble, or a very small stop is

used, it is advisable to insert a diaphragm of a size larger than you mean to employ, and focus for objects in the foreground or near middle distance, then insert the working stop, which ought to give sufficient sharpness to the distant scenery. A view is spoilt when the foreground is not the sharpest part of the picture; so insure this, and let the distance take care of itself; but it is necessary to avoid the opposite error, for when the lens is racked out for the near objects, as far as they will bear, no doubt all else will be completely lost.

Intensifying Negatives.—It frequently happens that negatives do not possess the requisite intensity, and it becomes necessary to strengthen them. There are several methods of doing so, and I shall give two, which are generally successful.

A few drops of tincture of iodine, made by dissolving pure iodine in alcohol, are added to distilled water, until it assumes a colour similar to pale ale. The picture, after it has been developed, fixed, and washed as usual in the dark room, is flooded with this aqueous solution of iodine, and allowed to remain about a minute, then well washed with running water, and exposed for a few seconds to diffused daylight; now intensify with a saturated solution of gallic acid and silver in the usual manner, by pouring it over the surface of the plate. It, of course, must be thoroughly removed by washing, when the requisite density is obtained, but it will not be necessary to employ the fixing solution a second time.

A negative that has been fixed and dried can be intensified by the aid of bichloride of mercury and hydrosulphate of ammonia. It is remarkably energetic, and is employed thus:—Ten grains of bichloride of mercury are dissolved in an ounce of water; the picture is flushed with this, when immediately a change commences in its appearance; at first it almost disappears, and is completely blackened; were the action continued, it would regain its original colour with a blue tone, similar to the alabastrine positives; for the present purpose, it is not necessary to let it proceed so far, else the film becomes excessively tender; but when the mercury has completely penetrated the collodion, wash it off, and apply a dilute solution of hydrosulphite of ammonia, say one drachm to the ounce of water; the density of the picture now rapidly increases, and, when carried sufficiently far, wash with a stream of water and dry gradually. Should the picture have been dried before this process is commenced, it is advisable to varnish round the edges with a little quick-drying varnish, to prevent the moisture penetrating under the film. Chloride of palladium has been recommended for the increasing the density of the negative, but the results are not so favourable; it is, moreover, a very expensive salt; and were it not for the unpleasant odour of the ammonia, there is no doubt it would be generally adopted in preference to all others.

To prevent the Film from slipping from the Glass.—When working by the Tannin, and occasionally by the Fothergill process,

more especially when employing large plates, the film is tender, and easily washes up, even after the greatest care has been taken to clean the glasses, and let the collodion set before immersion in the bath; it is, therefore, necessary to prepare the surface in some manner previously. There are many means of doing this, either with thin albumen, gelatine, or gum arabic; but, perhaps, the best substance is isinglass. One grain dissolved in an ounce of water will be sufficiently thick. It is more difficult to get this evenly over the plate than may be supposed; the readiest plan is to stand the plate on a levelling-stand, and, pouring a good pool on the centre, guide the fluid with a glass rod into those parts where it does not readily flow, drain off the superfluous portion into a separate bottle, and filter it before using a second time; the glasses are now reared up on end to dry, and packed away in plate-boxes until required. A solution of gelatine, eight grains to the ounce of water, or albumen diluted with equal bulk of water, is used in the same manner.

When coating a gelatinized plate, it is necessary to cover it up to the extreme corners with collodion, or the nitrate bath will be injured from contact with the organic matter; for the same reason none should be allowed to run over the back of the glass, or over the edges of the plate.

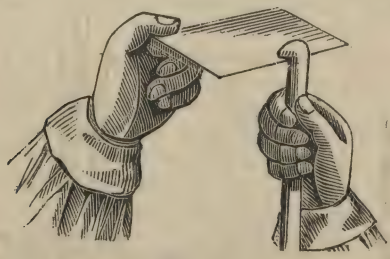


Fig. 24.

For small glasses, say up to 7 × 6 inches, it is sufficient to roughen the surface round the edges to the depth of, say the eighth of an inch. A convenient way of doing this is by a piece of hard notched wood or stone, moistened with emery and water, similar to *Fig.* 24. Glasses that have been used once, after the edges have been ground in this manner, require thorough cleaning; in fact, it is advisable to rub them again with the wood block and emery, to remove portions of the film which obstinately adhere to the ground portion of the glass.

Strength of Silver Solutions.—It is of importance that the silver solution, especially for printing purposes, be kept up to the standard strength. An instrument capable of determining this point with tolerable accuracy has, for a considerable time, been in use; it is

made in the form of an hydrometer, and acts on the principle that the specific gravity of the solution will vary in proportion to the quantity of silver it contains.

The stem of this instrument contains an ivory scale, graduated from 0° to 80°; and at the bottom is a glass ball containing quicksilver, which so regulates its buoyancy as to float it in plain water at the zero line. If nitrate of silver is now added to this water, in the proportion of ten grains to the ounce, the density will become greater, and the hydrometer rises until it floats at the division marked 10°; were a larger quantity added, to increase the strength to thirty grains to the ounce, the surface of the fluid would cut the scale at the 30°, and so for any other proportion; it, therefore, is only necessary, in order to determine the strength of a bath, to immerse it, and the proportion of silver to water is shown at once.

I wish to be understood, that the specific gravity of the liquid is the only proof given by this instrument; and if any experimental novice has dissolved other salts besides nitrate of silver in his bath, it will influence the indications of this instrument; but, under ordinary circumstances, it proves the correct strength within a few grains, or near enough for all practical purposes. I recommend it without hesitation, in preference to a more complicated form of argentometer.

Fig. 25.

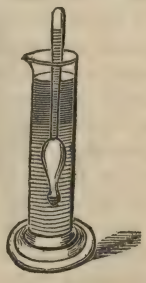


Fig. 26.

It packs into a neat leather case, to preserve it from injury, and is shown by *Fig.* 25, or when in use by *Fig.* 26.

Specific Gravity of Fluids.—The success attending the manufacture of collodion will, to a considerable extent, be modified if the specific gravity of the acids, ether, alchol, &c., is not correct. The most exact method of determining this is by a *specific gravity bottle*, which resembles a glass globe, furnished with a perforated stopper.

The specific gravity bottle holds exactly 1000 grains of distilled water, at a temperature of 60° Fahrenheit; and when placed in a delicate balance, is exactly counterpoised by a brass weight sold with it.

In order to ascertain the specific gravity of any fluid, fill the bottle

with the liquid to be tested, and insert the stopper; the excess will escape through the perforation; then wipe the outside perfectly dry, and place it in the balance; in the opposite scale pan put the counterpoise, and observe the number of grains required to produce equilibrium; these, either added to or subtracted from 1000, the assumed specific gravity of water, gives the density of the fluid. For instance, were the bottle filled with absolute alcohol and put into the scales, it would require 200 grains placed with it to counterbalance the brass weight; the number subtracted from 1000 gives ·800, the correct specific gravity. Had the bottle been filled with nitric acid, it might have been 500 grains heavier than the counterpoise; therefore showing the specific gravity to be 1·500.

If the temperature is higher or lower than 60°, it should be raised or lowered to that point, when a correct reading is required.

Mounting Prints.—An apparently simple operation like mounting photographs requires practice and dexterity to perform neatly. I do not know a better adhesive substance than starch or dextrine; the print is laid face downwards on a slab of glass, and the paste brushed evenly over the back; then damp the surface of the cardboard with a sponge, thus causing it to slightly expand; now carefully lower the proof down to its place, press into contact all over, and dry off between pressure if possible. The motive in wetting the cardboard is to prevent cockling, which it would be sure to do from the contraction of the print, were the board not previously damped. When dry, lay a sheet of *fine* clean paper over it, and rub down with a warm flat iron. Where the facility of hotpressing is to be had, it is a great improvement, giving a surface and brilliancy to the picture.

Clearing Albumen, Collodion, Varnishes, &c.—Floating particles frequently arise from various causes in these chemicals, and it is necessary to filter them; much trouble is often occasioned by the difficulty in getting them to pass the filter paper; or, if they do pass, they mostly carry through small portions of the deposit as well: albumen especially, if tolerably thick, will not pass at all, and a piece of fine cambric doubled to two or three thicknesses must be employed, or else a plug of sponge in the neck of the funnel; but if the time can be spared it will settle beautifully bright, when the top portion can be drawn off with a syphon.

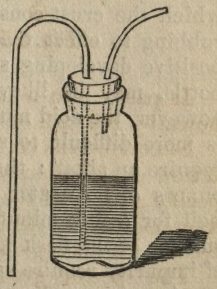


Fig. 27.

Fig. 27 shows the arrangement: it is a glass bottle, with a close-fitting cork. A bent glass tube is inserted through sufficiently far to reach within an inch or two of the bottom. Another short length is also inserted, but does not pass down as low as the fluid: now, by blowing into this short tube, the upper portion of the bottle is filled with compressed

air, which, pressing on the liquid, forces it over the bend of the tube: it then continues to act until the bottle is emptied.

Collodion and varnishes are cleared in the same manner ; but if the latter are only required in small quantities, they may be passed through filter-paper. The ordinary circular filters obtained from dealers in materials are not sufficiently fine for delicate purposes ; therefore use white bibulous paper, or the thick English filter-paper procured in large sheets ; cut these into circles, about the size required, which fold into four, and lay in a glass funnel as usual.

The use of Test Papers.—The following precautions are requisite in using test papers, or the carbonic acid always present in the air in small quantities will turn them purple, unless protected from the action of the air in glass tubes or bottles; the blue colour, however, can be restored by immersion in water, containing about one drop of liquor potassa to the five ounces of water, or by holding them in the vapour of ammonia.

Tests, prepared with porous paper, show the red colour better than those made with glazed or strongly-sized paper. If the quantity of acid present is, however, small, it is not sufficient in any case simply to dip the paper in the liquid: a small strip should be thrown in and allowed to remain for ten minutes or a quarter of an hour. If the paper, on immersion, assumes a wine red or purple tint in place of a decided red, it is probably caused by carbonic acid gas. In that case the blue colour returns when the paper is washed and held to the fire. Blue litmus paper may be changed to the red paper used for alkalies by soaking in water, acidified with sulphuric acid, one drop to half a pint, or by holding them in the vapour of acetic acid for a few minutes; but they are not so sensitive as when made red with acid litmus at the time of preparation.

Cleaning Dirty Bottles.—If the bottle has a deposit, arising from hard water being left in it, rinsing out with dilute hydrochloric acid will immediately dissolve off the carbonate or sulphate of lime, of which the crust consists, whereas it would require long-continued hard rubbing to effect the same mechanically. Stains of iron, arising from positive developing solution or perchloride of iron, having stood in the bottle, may be likewise removed by the same solvent; in this case, however, the acid must be used strong and slightly warm, as the deposit is more difficult to remove. Other impurities, such as oil or grease, require an alkali: thus, to clean a Florence flask, place in it a couple of ounces of hot water and half an ounce of common washing soda, and boil for a few minutes, shaking round, so that all parts of the inner surface of the flask are brought in contact with the soda. Other kinds of impurity require special solvents to loosen them. Methylated spirits of wine and pyroligneous spirit (wood naphtha), will also be found useful, the latter especially, in cleaning out bottles which have contained collodion, and have a film dried on the inside, as it is a good solvent for

pyroxyline; black varnish is also readily dissolved by this liquid. It is, however, unadvisable in many cases to resort to *chemical* methods of cleaning bottles until mechanical ones have been tried and failed, as even, if the latter do not perfectly succeed, they frequently leave very little to be effected by the solvent, thus avoiding unnecessary expense, for the value of a few minutes' labour is less than that of a chemical solvent; therefore, try the following plan first, and then, if the dirt be very refractory, it can be treated chemically:—About half fill the bottle with pieces of filtering-paper, and then put in a little coarse sand or fine gravel (about an ounce for a six-ounce bottle), and just sufficient water to make the whole assume the consistency of paste when shaken up for some time. Now introduce the cork or stopper, and shake it violently for some minutes, turning the bottle round so as to make sure that all parts have been exposed to the friction; then add water and rinse it out, and, in nine cases out of ten, the bottle will be quite clean.

Removal of Stains and Spots from Linen Fabric or from the Hands.—Accidental stains and spots frequently occur in the practice of photography, even with the most careful manipulators, and are a source of annoyance to many persons who do not care to be recognized as votaries of the "Black Art," for which reason they wear finger-stalls or gauntlets. The simplest and best plan I have seen recommended is to use a piece of mackintosh cloth in the left hand, and to hold the plate with this between the fingers and thumb; but wash this cloth in clean water, and wipe it dry after each picture has been taken, or you will risk staining the next plate. When the stains do occur, they may be removed by a plan suggested by an eminent French authority, which is this:—

Mix together—

Common alcohol	5 ounces.
Iodine	1 drachm.
Nitric acid	1 drachm.
Hydrochloric acid	1 drachm.

These produce a reddish liquid, which, when applied to stains caused *by any salts* of silver, immediately converts them into chloride and iodide of silver, soluble in hyposulphite of soda, and cyanide of potassium.

The effect is especially marked on stained linen; when a black patch is touched with the liquid, by means of a little brush, it instantly turns yellow, with a violet border, if the linen has been starched; on washing with the hyposulphite or with the cyanide, the violet tint immediately vanishes, and the yellow spot by degrees. It is well to wash the stained place after the application of the iodized solution to remove the acids, which might produce independent stains by contact with the hyposulphite or the cyanide.

For the hands, the operation is the same; only, instead of using a brush, the skin may be rubbed with a piece of rag or cotton. Washing with a weak solution of cyanide of potassium will be preferable to the hyposulphite of soda, on account of the persistent odour of sulphur left by the latter; but then care must be taken to rinse the hands well, to avoid the evolution and absorption of prussic acid.

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